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FIFTY-FIFTH REPORT OF THE STATE MINERALOGIST

GORDON B. OAKESHOTT
State Mineralogist and
Chief, Division of Mines

California Division of Mines
Ferry Building, San Francisco, 1959

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DEPARTMENT OF NATURAL RESOURCES
DeWITT NELSON, *Director*

DIVISION OF MINES
GORDON B. OAKESHOTT, *Chief*

Fifty-Fifth Report
of the State Mineralogist

Price $1.00

Services of the Division of Mines . . . . .

The Division of Mines maintains at its headquarters offices in San Francisco a technical library containing several thousand books and scientific journals on geology, mining, mineralogy, chemistry, metallurgy, and related subjects; a reading room containing periodicals devoted to the petroleum and mining industries, and newspapers from the mining centers of the state; exhibits of minerals, rocks, mine models, etc.; a service laboratory for the determination of California minerals; and a conference room with a mining engineer in attendance to serve the public and to sell publications of the Division. Publications are also sold at the Los Angeles, Sacramento, and Redding branch offices.

In addition to oral conferences in the offices of the Division of Mines, information concerning the mineral resources, mineral industry, geology, and mining operations of California is distributed to the public by means of publications, monthly releases, and letters. Each letter of inquiry received by the Division is answered by the technical staff member best qualified to do so.

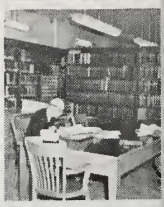
The principal publications of the Division of Mines are the Report of the State Mineralogist, issued annually; the Bulletin and Special Report series, county reports, and maps, issued at irregular intervals; and Mineral Information Service, a pamphlet issued monthly, which is designed to inform the public on the geology and mineral resources of California and on the usefulness of minerals and rocks, and to serve as a news release on mineral discoveries, mining operations, markets, statistics, and new publications. A list of available publications will be sent free upon request.

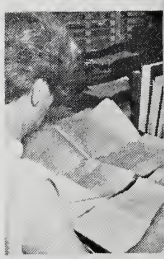
Communications to the Division of Mines, including orders for publications, should be addressed to the headquarters office.

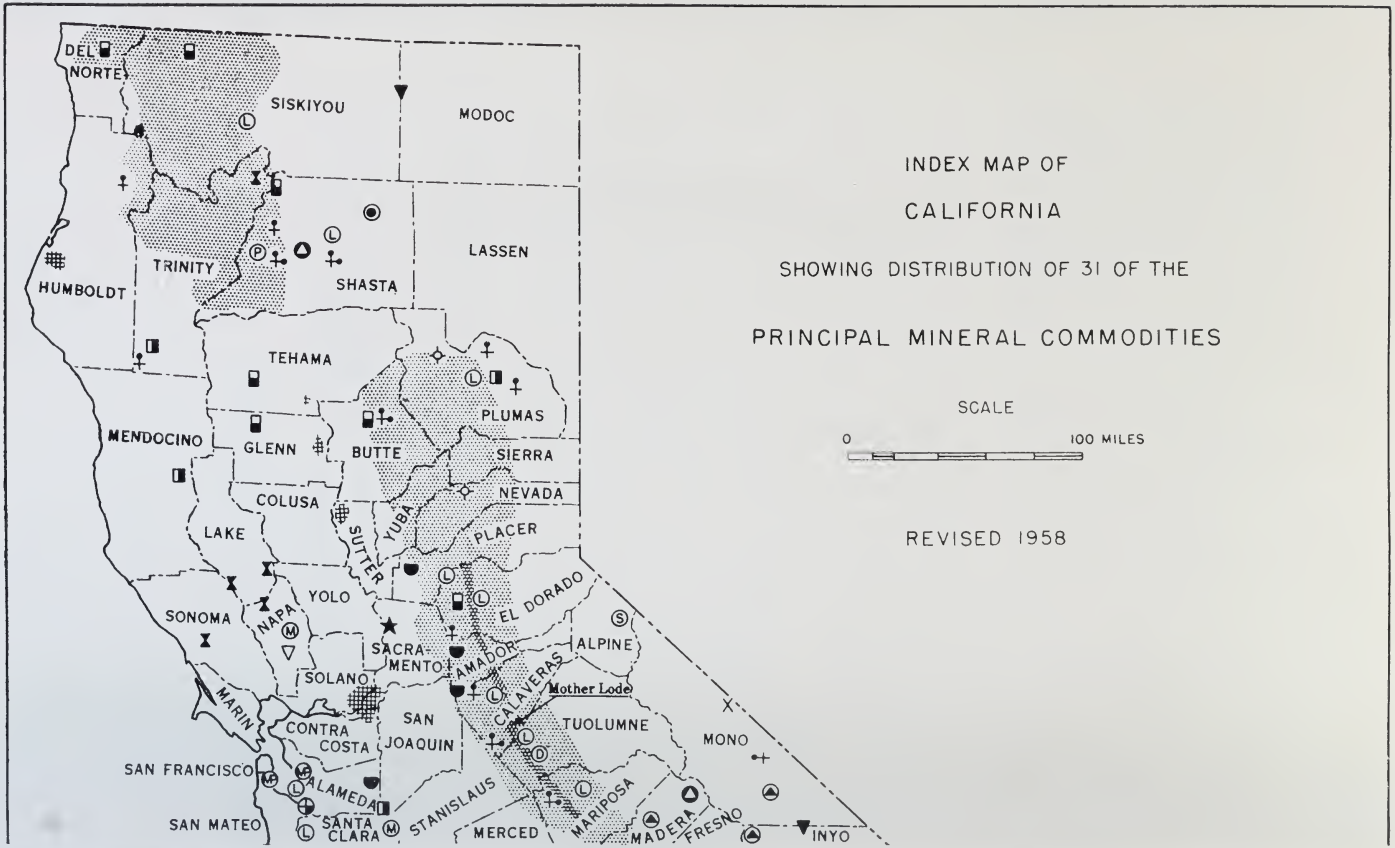
Headquarters office: California Division of Mines, Ferry Building, San Francisco 11, California.

Branch offices: State Building, 217 West First Street, Los Angeles 12; Business and Professions Annex, 1021 "O" Street, Sacramento 14; Natural Resources Building, Cypress and Lanning Streets, Redding.

GORDON B. OAKESHOTT, *State Mineralogist and Chief, Division of Mines.*



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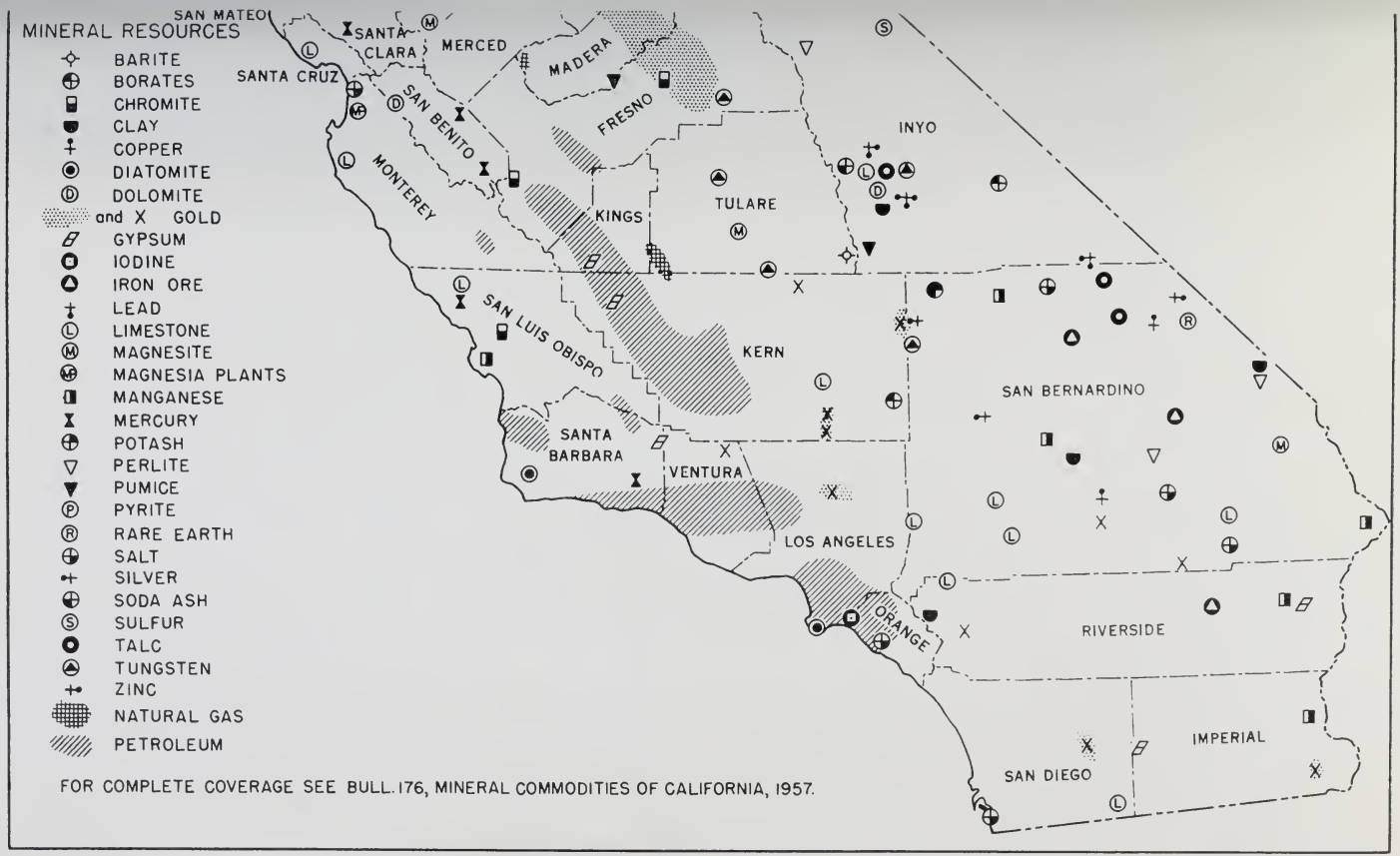
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RARE EARTH
SALT
SILVER
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NATURAL GAS
PETROLEUM
SAN MATEO
SANTA CLARA
SANTA CRUZ
MERCED
MADERA
FRESNO
SAN BENITO
MONTEREY
KINGS
TULARE
INYO
SAN LUIS OBISPO
KERN
SANTA BARBARA
VENTURA
LOS ANGELES
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FOR COMPLETE COVERAGE SEE BULL. 176, MINERAL COMMODITIES OF CALIFORNIA, 1957.

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By Gordon B. Oakeshott and Staff

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LETTER OF TRANSMITTAL

Mr. DeWitt Nelson
Director, Department of Natural Resources
Sacramento, California

Sir:

I have the honor to transmit herewith for reference to Governor Goodwin J. Knight the Annual Report of the State Mineralogist, Chief, Division of Mines, for the 109th fiscal year, July 1, 1957 to June 30, 1958. This is in compliance with amended Section 2203 of the Public Resources Code. Pertinent sections of the Code are quoted early in this report to indicate the authority under which the Division operates.

Principal activities of the Division of Mines are summarized to show the program the Division has been following to perform its functions as the state's public information bureau on its basic geology, mines, and mineral resources. Activities and operations of the Division are planned to aid and encourage the economic development of the mineral resources of California. The vast developed and potential mineral resources of our state have offered a continuing challenge to the technical staff of the Division which has been able, in many instances, to offer fundamental information resulting in the development of new mineral industries as well as to contribute to long-range programs. The total value of mineral production in California in 1957 reached the all-time high of over 1.6 billion dollars, the tenth consecutive year it has exceeded one billion dollars.

During the first 8 months of the fiscal year the Division continued under the administration of Olaf P. Jenkins; on March 1, 1958 he was succeeded as State Mineralogist, on temporary authorization, by Gordon B. Oakeshott, formerly Deputy Chief, Division of Mines.

Respectfully submitted,

Gordon B. Oakeshott
State Mineralogist and
Chief, Division of Mines

Ferry Building, San Francisco
September 15, 1958

PHOTO 1. Olaf P. Jenkins (left), retiring Chief of the Division of Mines, receives acknowledgment of "his many years of service contributed to the mining industry and . . . his outstanding work as Chief of the California State Division of Mines" from Henry Mulryan, representing the industry.

ABSTRACT

The value of mineral production in California reached the all-time high of 1.65 billion dollars in 1957; but the amount of production declined somewhat because of falling metal market prices and less Government support, and falling output of the petroleum products. High prices of petroleum were responsible for the high total value. Petroleum products accounted for 77 percent of the value of mineral production; nonmetallic or industrial minerals, 20 percent; and the metals, 2.7 percent. Capacity for new and increased production of the nonmetals was greatly expanded, with notable developments in the mines, plants, and processing of borates, cement, clay products, and magnesia.

Chief of the Division of Mines since 1947, Dr. Olaf P. Jenkins, retired on March 1, 1958 and was succeeded, on temporary authorization, by Dr. Gordon B. Oakeshott, formerly Deputy Chief. Richard M. Stewart was appointed Supervising Mining Geologist to assist the Chief in administration in San Francisco. Re-organization of the Division into four major sections, each headed by a Senior Mining Geologist, was completed. The Division had a total of 60 authorized positions, 33 of which were mining geologists or engineers. Expenditures for 1957-58 increased 13 percent over 1956-57 to $620,179, a reflection of increased prices paid for equipment, supplies, and services, and normal salary increases.

The Public Information Services section handled a large number of personal interviews, telephone calls, and letters of inquiry on the mining industry and geology—not only from California, but from all parts of the world. Material assistance was given to a large number of companies as well as individuals. Division mining geologists were active in the leading professional societies and cooperated with them on geological work in California. Staff geologists presented 56 talks on mineral resources, geology, and Division activities to schools and a wide variety of professional and lay groups. Over $1,600 of publications were sold at meetings of mineral societies and at mineral shows.

The Division's reference and research library in San Francisco has grown to 22,000 volumes, 300 periodicals, and 15,000 maps on geology, mining, and related subjects, with emphasis on California. The Library maintains a valuable exchange of publications with similar institutions in 48 foreign countries. Ninety-five sets of the school library set of selected Division publications were distributed to California schools, in response to written requests. About 160 new volumes were added to the Library by donation and purchase. Two hundred new California topographic maps were acquired through the cooperative program between the State Department of Water Resources and the Topographic Branch of the U. S. Geological Survey.

The program of publication continued on a slightly increased scale in 1957-58, with Division of Mines staff geologists authoring the largest proportion of reports and bulletins in the Division's history. All four series were represented: monthly *Mineral Information Service*, quarterly *California Journal of Mines and Geology*, Bulletins, and Special Reports.

Work on the very important county resources reports, dealing with mines, mineral resources, and geology, was especially active; Calaveras,

Contra Costa, Kern, San Diego, and Shasta Counties were nearing completion for early publication. However, about half the counties in the state are still covered by reports more than 10 years old.

Basic geologic mapping was done during the year by Division mining geologists, by the U. S. Geological Survey, and by University geologists. More than 15 quadrangle areas were in various stages of completion by Division geologists. Many more, in progress by cooperating agencies and individuals, are on file and are slated for publication by the Division.

The fiscal year 1957-58 was the first year of a 4-year state-approved program for publication of 1:250,000-scale, colored geologic maps to cover the state. The Death Valley and Alturas 1- by 2-degree map sheets were being printed by the lithographer as the year closed. The geologic compilation on eight sheets is either complete or well underway. Reconnaissance geoligic mapping was done by Division geologists for the Alturas sheet.

The mineralogy-petrology section made qualitative determinations of 4,035 ores, rocks, and minerals, and staff geologists carried on research as well. Work done by the staff included screen analyses of sands; determination of expansion properties of shale and perlite samples by use of the high-temperature furnace; spectrographic analyses; study of clay minerals by differential thermal analysis equipment; and the identification and study of rocks with the petrographic microscope. In the mineral exhibit, work in reclassification and cataloging progressed. More than 27,000 people visited the exhibits. Nearly 200 sets of rocks and minerals typical of California were distributed to public elementary schools within the state. A number of interesting minerals were acquired, by donation, for the mineral exhibit.

The fiscal year 1957-58 was a year of accomplishment in study of the state's resources by mineral commodities, for two major projects reached publication: the comprehensive Bulletin 176, *Mineral commodities of California*—one of the finest and most complete reports ever published on California's mineral resources—which was written and edited largely by staff geologists; and Bulletin 175, *Salt in California*, the most recent commodity study. A great deal of information has been amassed toward publication of comprehensive surveys on other commodities, including limestone and dolomite, silica, clay, perlite and obsidian, sand and gravel, and stone. Requests for information on these commodities and the geologic occurrence of petroleum are numerous.

Each of the branch offices of the Division carried on a full program of information service, field and office work on the preparation of county resources reports, specialized statewide mineral commodity investigations, and basic geologic mapping. The Los Angeles office has eight authorized technical positions, Sacramento two, and Redding two. The branches do not maintain laboratories, but do offer limited mineral displays and reading facilities. The personal and telephone information service has grown at a very rapid rate in Los Angeles.

PHOTO 2 (opposite). During fiscal 1957-58 work on an inventory of Contra Costa County's mines and mineral resources was completed for publication. Photo shows Mount Diablo, scenic focal point of the county. *Photo by Commercial Photo and View Co., courtesy East Bay Municipal Utility District.*

The U. S. Geological Survey continued its studies of mineral deposits in California during 1957-58 in cooperation with the State Division of Mines. Cost of the projects was $70,000, half of which was paid by the state. The six active projects were in the south Klamath Mountains, Sierra Nevada foothills mineral belt, eastern Sierra tungsten, Bishop tungsten, Mt. Pinchot quadrangle, and Panamint Butte quadrangle. The Bishop project was completed on June 30, 1958. A short-term project on Mt. Diablo mercury was completed during the year. Over the years of U. S. Geological Survey cooperation, the Division of Mines has received many worthwhile technical reports for publication and has also profited from the less formal interchange of information between geologists of the two agencies.

The U. S. Bureau of Mines cooperates with the Division by gathering production statistics from mine operators. Recently, the two agencies signed a cooperative agreement, with no direct funds involved, whereby the State Division will publish certain inventory and mineral processing and utilization studies done by the Federal Bureau. At the close of the fiscal year an inventory study of mercury in California was being edited for publication by the Division. The Division of Mines is cooperating with a number of state agencies on geological mapping problems, and with the Seismologic section of the U. S. Coast and Geodetic Survey and Seismograph Station of the University of California on investigation of geologic aspects of earthquakes. Active cooperation is carried on with universities in the state; in particular, the Division contributed $1,500 to cooperative work on clays with the University of California in 1957-58 and $1,000 to research on age investigation of rock formations. The annual amount of $8,000 is authorized for purchasing geologic maps and reports for publication by the Division, or for use in public information or in compiling the state geologic map. This purchase program has enabled the state to encourage basic work on geology and mineral deposits and to obtain a great many valuable contributions at extremely low cost. The Division continued its cooperation with the California Academy of Sciences on mineral exhibits.

During 1957-58, the Division administration, State Mining Board, and Director of the Department of Natural Resources thoroughly investigated the need for basic research and field studies in the minerals field. The matter was reviewed at a series of public meetings, and a joint report, prepared by the Division of Mines and University of California, on appropriate research, was presented to the State Legislature in March, 1958, as directed by Senate Concurrent Resolution 84. This is to be followed by a 5-year budgeted plan to be jointly submitted to the Legislature at its 1959 session. The Division has requested $111,000 to modernize laboratory facilities and to employ minimum technical personnel in 1959-60.

The Division of Mines was able to materially assist the mineral industries in California during 1957-58 by providing complete, authoritative information service; by mapping rock formations, mineral deposits, and mines; and by publishing scientific reports which led to the discovery and utilization of new mineral deposits. The Division is playing a fundamental role in developing California's raw mineral sources for California industry.

MINERAL PRODUCTION AND VALUE IN 1957

After 6 fruitful years of mineral production, characterized by increasing outputs of most mineral commodities, 1957 was generally a year of declining mineral yields, although price increases brought total value to the all-time high of $1.65 billion.

Declines were especially noticed in the metals group where a combination of falling market prices for base metals and suspension of the Government stockpile program for tungsten resulted in a substantial decline in output from 1956. In mid-year, when the price of lead dropped to 13½ cents per pound and the price of zinc dropped to 10¼ cents per pound, the Darwin and Shoshone mines of Inyo County ceased operations.

One of the big blows to the metals group was the closing in July of the two largest lode gold mines in the state. These mines, the Empire-Star group and Idaho-Maryland group, are both located in the Grass Valley district of Nevada County. They had been operating continuously for almost 25 years on a fixed-price product—gold at $35 per ounce. Meanwhile, during this period, they watched their costs increase and their profits approach the vanishing point. Their closing marked the end of an era of large-scale, low-grade ore production from the deep lode mines of California. A small production of lode gold continues to come from the high-grade lode mines in El Dorado, Sierra, and Siskiyou Counties. The large bucket-line dredges operating on the flood plains of the Yuba and American Rivers near the western base of the Sierra Nevada now produce most of the gold in California.

Two brighter spots in the metals-production picture were chromite and mercury. The quantity and value of production increased during the year for both of these commodities. In the case of chromite it was the maximum effort of producers who were working at capacity before the anticipated filling of the government stock-pile quota in mid-1958 (about a year earlier than the previously established termination date).

The increase in mercury production was based upon successful exploration work at some of the larger mines, partly financed by the Government Defense Minerals Exploration Administration program. The New Idria, Abbott, Altoona, and Buena Vista mines benefited under this program. The Guadalupe, the Buckman, and the New Almaden mines completed successful exploration on their own account.

In the nonmetal group the quantity and value of production declined, owing to a slackening in the demand for materials of construction. However, many new production facilities were completed during the year and the capacity for future mineral output in this field has been greatly expanded.

Some of the outstanding developments included conversion of the underground sodium borate mines in Kern County to open-pit operations; opening of the new Permanente cement plant in Cushenbury Canyon; construction of a large clay-products plant in Riverside County; opening of a flotation plant in Calaveras County to separate sand and clay of the Ione formation; and an expansion of facilities for producing magnesia from sea water at Moss Landing, Monterey County.

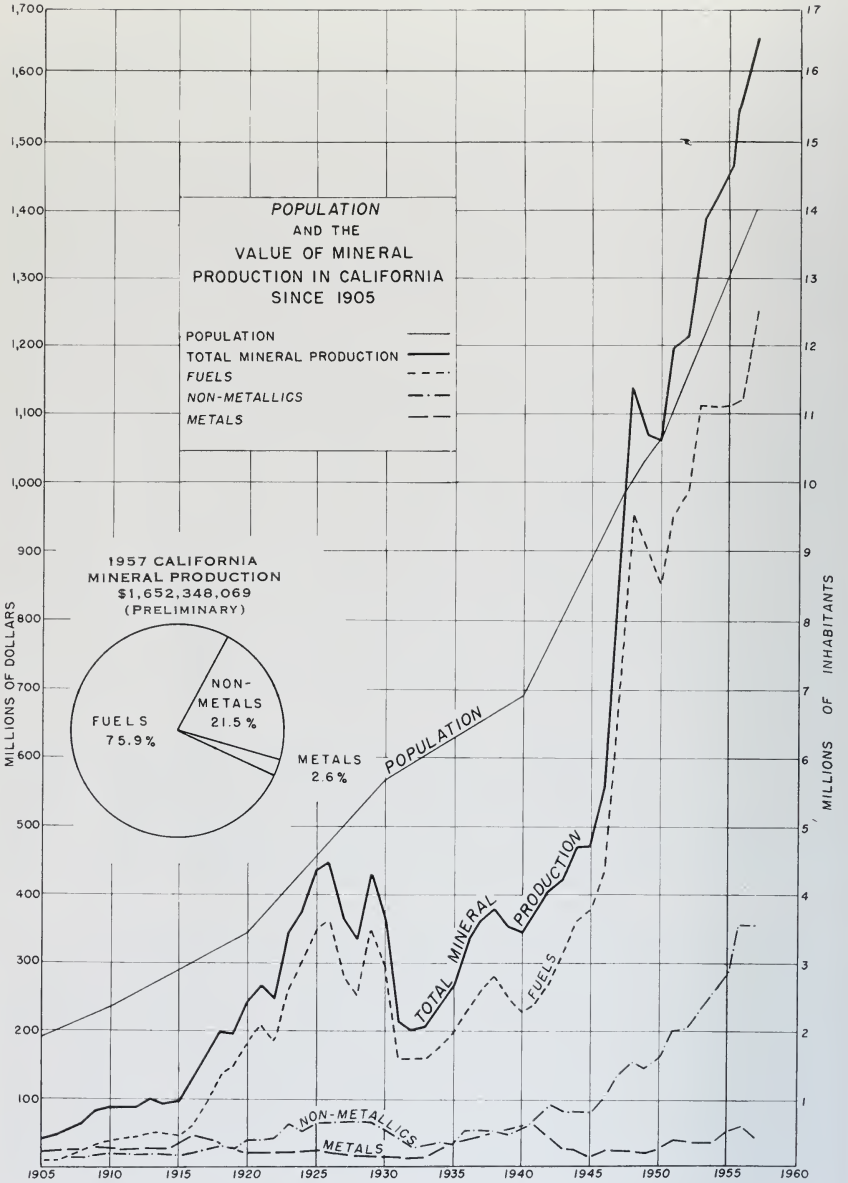

FIGURE 1.

All major members of the fuel group registered a decline in production during 1957. Petroleum (crude oil) production declined for the fourth consecutive year and was off 3 percent from 1956. However, a number of price increases during 1957 worked in favor of the output of California wells, so that more gross revenue was derived from less oil. The increase in the value of petroleum production was 12.6 per-

California mineral production in 1957.

Mineral commodity	Quantity	Value
Boron minerals and compounds	597,857 short tons	$40,816,821
Cement	37,731,340 barrels	117,852,259
Chromite (gross weight)	34,901 short tons	2,788,490
Clays	2,728,180 short tons	5,740,239*
Copper (recoverable content of ores, etc.)	945 short tons	568,890
Gem stones	----	100,000
Gold (recoverable content of ores, etc.)	170,885 fine ounces	5,980,975
Gypsum	1,268,021 short tons	2,995,106
Lead (recoverable content of ores, etc.)	3,458 short tons	988,988
Lime (open-market)	325,309 short tons	5,407,588
Magnesium compounds from sea water and bitterns (partly estimated) MgO equivalent	74,558 short tons	5,314,882
Manganese ore (+35 percent Mn)	9,121 short tons	802,310
Mercury	16,511 flasks	4,077,887
Natural gas (marketed production)	502,572 million cubic feet	114,416,000
Natural gas liquids:		
Natural gasoline and cycle products	843,378 thousand gallons	81,355,000
Liquid petroleum gases	390,743 thousand gallons	20,421,000
Peat	35,916 short tons	424,362
Perlite	15,109 short tons	113,476
Petroleum (crude)	339,646 thousand barrels	1,035,920,000
Pumice, pumicite, and volcanic cinders	459,089 short tons	1,510,131
Salt (common)	1,330,060 short tons	8,721,242
Sand and gravel	78,982,834 short tons	87,030,129
Silver (recoverable content of ores, etc.)	522,288 fine ounces	472,697
Stone	41,351,259 short tons	53,591,089*
Talc, pyrophyllite, and soapstone	133,915 short tons	1,525,660
Tungsten concentrate 60 percent WO_3 basis	1,750 short tons	2,735,160
Zinc (recoverable content of ores, etc.)	2,969 short tons	688,808
Unapportioned: asbestos, bromine, calcium chloride, coal (lignite); diatomite, feldspar, iodine, iron ore, lithium compounds, manganese ore (—35% Mn) and concentrates, mica (sericite), molybdenum concentrates, platinum group metals, potassium salts, pyrites, rare earth concentrates, slate, sodium salts, strontium minerals, sulfur ore, by-product sulfur, uranium ore	----	67,499,522
Total value for 1957 (preliminary)	----	$1,652,348,069*

* The total has been adjusted to eliminate duplication in the value of clay and limestone included in cement and lime; clay 690,390 short tons valued at $1,021,450; limestone 11,860,832 short tons valued at $16,489,192.

cent over 1956. It was the first time in history that the value of the petroleum production exceeded the billion dollar mark, totalling $1,035,920,000.

Reflecting these price increases, the total value of all mineral production in the state amounted to a new high level in 1957, as petroleum accounts for about 60 percent of the total figure—$1,652,348,069.

PUBLIC RESOURCES CODE: AUTHORITY FOR OPERATION OF DIVISION OF MINES

The State Mineralogist (Chief, Division of Mines), State Mining Board, and the Director, Department of Natural Resources, derive their authority for operating the Division of Mines, determining its policies, and administering its activities from the State Public Resources Code. Pertinent sections (numbered) of that Code are quoted as follows:

Mineral resources

"2205. The State Mineralogist shall:

(a) Make, facilitate, and encourage special studies of the mineral resources and mineral industries of the State.

(b) Collect statistics concerning the occurrence and production of the economically important minerals and the methods pursued in making their valuable constituents available for commercial use . . ."

"2207. The owner, lessor, lessee, agent, manager, or other person in charge of any mine of whatever kind or character within the State shall forward to the State Mineralogist, upon his request, at his office, not later than the thirty-first day of March in each year, upon forms which will be furnished, a report showing the character of the mine, the method of working the mine and the general condition thereof, and the total mineral production for the preceding calendar year. Any such person who fails to comply with the provisions of this section is guilty of a misdemeanor.

"Such reports shall be confidential. Other reports are public records unless excepted by the statute. Statistical bulletins based on these reports and published under the provisions of Section 2205 of this code shall be compiled to show, for the State as a whole and separately for each county, the total of each mineral produced therein, provided that, in order not to disclose the production of any operator, no production figure shall be published which represents the production of less than three operators; and when such production figure for any county would conflict with such provision it may be combined with such production figures for one or more other counties. Such bulletins shall be published annually by June 30th or as soon thereafter as practical."

Administration

"2201. The State Mineralogist shall employ competent geologists, field assistants, qualified specialists, and office employees when necessary in the execution of the plans and operations of the division under this chapter.

"2202. The State Mineralogist shall maintain offices, and a museum, library, and laboratory in San Francisco for the purposees provided in this chapter.

"2205. The State Mineralogist shall:

"(a) Make, facilitate, and encourage special studies of the mineral resources and mineral industries of the State.

"(g) Maintain, in effect, a bureau of information concerning the mineral industry of the State . . ."

State Mining Board

"507.1. State Mining Board: Members: Appointment: Qualifications: Incumbent members: Filling vacancies: Confirmation of appointments: Organization: Powers: Appointment of employees of Division of Mines. There shall be a State Mining Board, consisting of five members appointed by the Governor with the advice and consent of the Senate for terms of four years and until their successors are appointed and qualified. Members shall be selected from those citizens of this State associated with or having detailed knowledge of the prospecting for, production, processing or marketing of the minerals of this State.

The members of the incumbent Mining Board, continued in office, shall be classified by the Governor so that the term of office of one member shall expire January 15, 1950 and the terms of two members on January 15, 1951 and January 15, 1952, respectively. An appointment to fill a vacancy occurring before the expiration of a term shall be only for the remainder of that term. All appointments made when the Legislature is not in session shall be subject to confirmation at the next regular or special session of the Legislature. The board shall have power to organize itself and select its officers.

The board shall represent the State's interest in the development, utilization and conservation of the mineral resources of the State. It is empowered to establish policies conforming to the provisions of state statutes to govern the administration of the Division of Mines.

The director may authorize the State Mineralogist to exercise his power to appoint employees of the Division of Mines in accordance with the State Civil Service Act. The director may authorize the State Mineralogist or any employee of the Division of Mines to exercise any power granted or perform any duty imposed upon the director by the State Civil Service Act. (Added by Stats. 1949, Ch. 1081, Sec. 2.)"

Ore buyers' inspection

"2250. It is unlawful for any person to engage in the business of milling, sampling, concentrating, reducing, refining, purchasing, or receiving for sale, ores, concentrates, or amalgams bearing gold or silver, gold dust, gold or silver bullion, nuggets, or specimens without first procuring the license provided for by this chapter.

"2253. The application for a license to carry on such business shall be made to the State Mineralogist. . .

"2267. Every licensee under this chapter shall file monthly with the State Mineralogist a report of all purchases made under this chapter. The reports shall be made upon forms prescribed by the State Mineralogist and shall contain the information required by this chapter."

Mining activities

"2208. The State Mineralogist or a qualified assistant may at any time enter or examine any and all mines, quarries, wells, mills, reduction works, refining works, and other mineral properties or working plants in this State in order to gather data to comply with the provisions of this chapter."

Information, laboratory, and exhibits

"2202. The State Mineralogist shall maintain offices and a museum, library, and laboratory in San Francisco for the purposes provided in this chapter.

"2204. The State Mineralogist may receive on behalf of this State, for the use and benefit of the Division, gifts, bequests, devises, and legacies of real or other property and may use the same in accordance with the wishes of donors. If no instructions are given by the donors, the State Mineralogist shall manage, use, and dispose of the gifts, bequests, and legacies for the best interest of the Division and in such manner as he may deem proper.

"2205. The State Mineralogist shall: . . .

"(c) Make a collection of typical geological and mineralogical specimens, especially those of economic and commercial importance, such collection constituting the museum of the division.

"(d) Provide a library of books, reports, and drawings bearing upon the mineral industries, the sciences of mineralogy and geology, and the arts of mining and metallurgy, such library constituting the library of the division.

"(e) Make a collection of models, drawings, and descriptions of the mechanical appliances used in mining and metallurgical processes.

"(f) Preserve and so maintain such collections and library as to make them available for reference and examination, and open to public inspection at reasonable hours.

"(g) Maintain, in effect, a bureau of information concerning the mineral industry of this State to consist of such collections and library, and arrange, classify, catalogue, and index the data therein contained, in a manner to make the information available to those desiring it.

"2206. The State Mineralogist may prepare a special collection of ores and minerals of California to be sent to or used at any world's fair or exposition in order to display the mineral wealth of the State."

ADMINISTRATION

The Division of Mines is one of several divisions in the Department of Natural Resources. The headquarters of the Department and its Director are in Sacramento. The State Mining Board, consisting of five members appointed by the Governor and serving without compensation, advises the Director and the Chief, Division of Mines, on matters of policy.

The headquarters office of the Division of Mines is located in the south wing of the Ferry Building, San Francisco. The Division's work is directed by the Chief of the Division, the State Mineralogist, from the headquarters office, which also houses the Editorial, Drafting, Library, and Laboratory sections. The three branch offices, the largest in Los Angeles and smaller ones in Redding and Sacramento, extend services directly to the public in those areas.

PHOTO 3 (opposite). Kennedy mine headframe, seen through the tailing wheels, Jackson, Amador County. This historic gold mine is described in Bulletin 141, *Geologic Guidebook Along Highway 49—Sierran Gold Belt—The Mother Lode Country*, prepared and published under the aegis of Dr. Olaf P. Jenkins, retiring Chief of the Division of Mines. One of the most popular publications of the Division, the book is now in its fourth printing. *Photo by Mary Hill.*

For most of the year, the Chief, Olaf P. Jenkins, was assisted in the administration and direction of the Division by the Deputy Chief, Gordon B. Oakeshott. On March 1, 1958, Dr. Jenkins retired and Dr. Oakeshott was appointed Chief pending the results of an examination open to applicants from the entire country.

Dr. Jenkins' retirement marked the end of nearly 29 years of continuous service with the Division of Mines. From July 1, 1929, until February 1, 1947, he served as Chief Geologist of the Geologic Branch. During this time he was responsible for many well-known publications, among which is the large colored state geologic map of 1938; Bulletin 118, *Geologic formations and economic development of the oil and gas fields of California;* and a paper known as *Study of placers* that proved very popular. All these have long been out of print.

In 1947, Dr. Jenkins was appointed Chief of the Division and during the next 11 years the Division doubled in size. Under his direction the output of technical publications on the geology and mineral resources of California became internationally known and appreciated for the high quality of the work and its usefulness to science. Among the best known publications is the series of geologic guidebooks—bulletins 141, 154, 170—Mother Lode country, San Francisco bay counties, and geology of southern California, respectively.

Among several other books prepared under Dr. Jenkins' direction, which proved popular enough to require reprinting, are bulletins 156, 158, 173—on mineral commodities, California landscape, and minerals of California, respectively. A greatly enlarged and completely rewritten issue of *Mineral Commodities of California*, Bulletin 176, has only recently been published. This is an integrated summary of geology, economics, mining, and potential sources of mineral supply to the state. Comprehensive commodity summaries such as this, and the series of statewide economic mineral maps, together with special commodity bulletins 129, 134, 144, 152, 162—on iron, chromite, copper, manganese, and gypsum, respectively—supply fundemental information necessary in the development of the fast-growing industries of California.

Many other reports on geologic and mining subjects were published during Dr. Jenkins' administration, such as bulletins 171 and 169 on earthquakes, and clay technology; quadrangle geologic maps, of which about four dozen have appeared and many more are to come; and a series of about 50 Special Reports on a great variety of subjects.

Besides this wealth of documentary detailed data, the Division's monthly pamphlet *Mineral Information Service*, issued since 1948, brings praise from all parts of the world for its constant usefulness and reliability.

Dr. Jenkins' retirement necessitated organizational changes for Division administration in the San Francisco office. Dr. Gordon B. Oakeshott was appointed Chief, on a temporary basis, and the Division organization was changed to provide administrative functioning as indicated in the accompanying organization chart. Richard M. Stewart was appointed Supervising Mining Geologist in charge of administrative services and county resources reports, and was given direct responsibility for the necessary drafting, editorial, stores and business management services. The one Senior Mining Geologist position in charge of mineral commodities and mineral utilization surveys was left vacant; the functional duties in those areas were distributed, temporarily, among the other Senior Mining Geologists and the Supervising Mining Geologists.

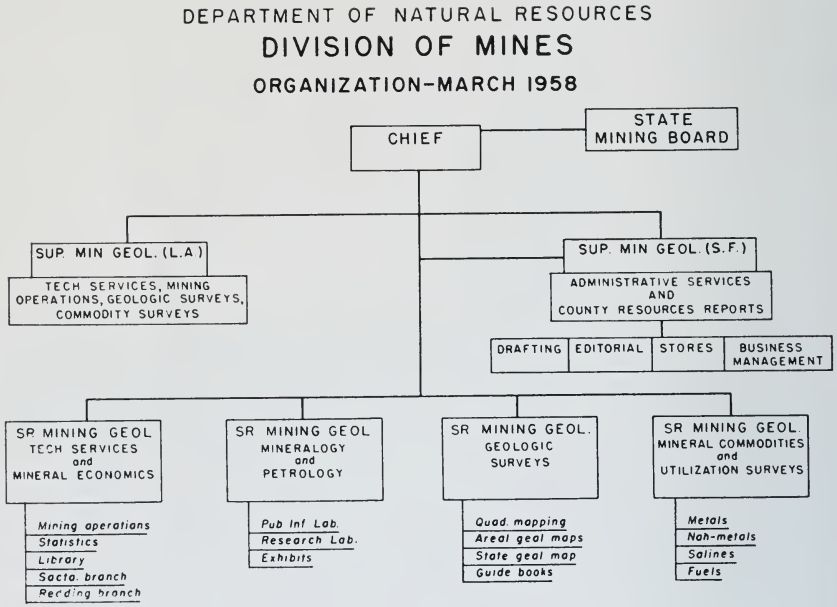

FIGURE 2.

The Editorial section, which processes technical manuscripts for publication, is supervised by Information Officer Elisabeth L. Egenhoff. The Drafting section, headed by Supervising Geological Draftsman Richard A. Crippen Jr., prepares charts, maps, and illustrations for the publications. Librarian William A. Sansburn is in charge of the Division's technical library which serves the public at the San Francisco headquarters office and also distributes sets of Division publications to public school teachers and students, and maintains a film lending library on the mineral industry.

At Los Angeles, Sacramento, and Redding are the branch offices which carry on the phases of Division work most effective and most needed in their respective parts of the state. Los Angeles, the largest, is headed by Supervising Mining Geologist Lauren A. Wright; Sacramento by Associate Mining Geologist William B. Clark. The Redding

office is under the direction of District Mining Engineer J. C. O'Brien. This last office was enlarged by the addition of Associate Mining Geologist Thomas E. Gay Jr., who was transferred from the Los Angeles office early in the fiscal year.

During fiscal 1957-58 the number of authorized positions was 60; one technical position, a Junior Mining Geologist in Los Angeles, was left vacant to effect budget economy. A list of the technical staff of the Division of Mines as of June 30, 1958, with the major assignments and interests of each follows:

Technical Staff Assignments

AUNE, QUINTIN A.—Antimony, arsenic, bismuth, bentonite; geologic reconnaissance Alturas area; Modoc County.

BOWEN, OLIVER E., JR.—Supervision of Geologic surveys and guidebooks section; cement, limestone and dolomite; bulletin on limestone and dolomite; Monterey County; Monterey and El Portal quadrangles; Cherokee mine.

CHESTERMAN, CHARLES W.—Supervision of Mineralogy—Petrology section; expansible shale, pumice and perlite, volcanic rocks, fluorspar, jade; Matterhorn Peak and Bodie quadrangles; Dublin Hills area.

CLARK, WILLIAM B.—Supervision of Sacramento branch office; technical information services; Calaveras County; gold, platinum; Greenwood quadrangle.

CLEVELAND, GEORGE B.—Los Angleles office; aluminum, clay, diatomite; Otay bentonite; Little Antelope clay.

CRIPPEN, RICHARD A., JR.—Supervision of Drafting section; drafting illustrations for publication.

DAVIS, FENELON F.—Supervision of technical information services and mineral economics section; mining activities; manganese, mercury; Alameda County.

EGENHOFF, ELISABETH L.—Supervision of Editorial section; technical editing; history of mineral discovery and mining in California.

EVANS, JAMES R.—Technical information services and laboratory. (In training for assignment to Los Angeles office.)

GARY, GEORGE L.—Mineral exhibits; ore buyers' inspection and licenses.

GAY, THOMAS E., JR.—Technical information services at Redding branch office; geologic reconnaissance Alturas area; Modoc County; Coffee Creek area; iron and ferroalloys.

GOLDMAN, HAROLD B.—Dimension stone and rock products; Alameda County; Franciscan chert in concrete aggregate; reactive materials in aggregates; aggregate resources of river-drainage systems.

GRAY, CLIFFTON H., JR.—Los Angeles office; Limestone and dolomite; tin; Corona South quadrangle; Orange and Riverside Counties.

HART, EARL W.—Asphalt and bituminous rock, natural gas, natural-gas liquids, petroleum; Standard limestone and dolomite; Kern County petroleum; Monterey County.

JENNINGS, CHARLES W.—State geologic map; supervision of topographic map filing and distribution; index to geologic mapping projects; review of geologic maps for publication; Hernandez Valley quadrangle; coal, peat.

KELLEY, FREDERIC R.—Clay, phosphates; Cretaceous stratigraphy, Joaquin Rocks quadrangle; Cherokee sediments.

KIESSLING, EDMUND W.—Assisting on all petroleum resources; Lockwood Valley area; glossary of California geologic names.

LYDON, PHILIP A.—Technical information services at Sacramento branch office; Calaveras County; pyrite, sulfur and sulfuric acid, titanium; Kaiser Peak and Mt. Abbot quadrangles; geology of Poe tunnel.

MATTHEWS, ROBERT A.—Mineralogy—Petrology section, X-ray and spectroscope; chromite.

MORTON, PAUL K.—Los Angeles office; ore deposits of Kern County; cadmium, lead, silver, zinc (southern California), gold (southern California).

OAKESHOTT, GORDON B.—Chief, Division of Mines (State Mineralogist); Division administration; geology of the Coast and Transverse Ranges; geology of active faults and earthquakes.

O'BRIEN, J. C.—Supervision of Redding branch office; copper, zinc; Shasta and Trinity Counties.

RICE, MARY H.—Technical editing; Mineral Information Service; photography.

RICE, SALEM J.—Asbestos, chromite, cobalt, nickel, serpentine; geologic guide to north coast; caves of California.

SANSBURN, WILLIAM A.—Librarian.

SAUL, RICHARD B.—Los Angeles office; Riverside County; manganese (southern California); geology of parts of Inyo Mts.

STEWART, RICHARD M.—Assisting Chief in Division administration and supervision; supervision of administrative services and county resources reports sections; mineral utilization.

STINSON, MELVIN C.—Assisting in supervision of Mineralogy—Petrology section; black sands, minor metals, rare-earth elements, uranium, vanadium, zirconium and hafnium; Chilcoot and Haiwee Reservoir quadrangles.

STRAND, RUDOLPH G.—State geologic map; compilation geologic map of Great Valley; index to geologic mapping.

SYMONS, HENRY H.—Technical information services; mineral economics and statistics; mining operations.

TROXEL, BENNIE W.—Assisting in supervision of the Los Angeles branch office; molybdenum, thorium, tungsten, wollastonite; Shadow Mountains and southern Death Valley; Kern County.

VER PLANCK, WM. E.—Bulletin on silica; borates, bromine and iodine, calcium chloride, gypsum, lithium, magnesium compounds, nitrogen compounds, potash, salines, sodium salts, strontium compounds.

WEBER, F. HAROLD, JR.—Los Angeles office; San Diego County; geology and mineral deposits of part of Ord Mts.; barite.

WRIGHT, LAUREN A.—Assisting Chief by administration and supervision of the Los Angeles branch office; geology of southern Death Valley; beryllium, optical calcite, feldspar, gem stones, kyanite, mica, quartz crystal, talc and pyrophyllite.

Financial Statement

The statement of expenditures for the fiscal year 1957-58 is approximate inasmuch as all bills for the year were not available for payment at the time this report was prepared. These approximate expenditures are compared below with actual expenditures for the years 1954-55, 1955-56, and 1956-57:

Expenditures 1954-55	$471,613
Expenditures 1955-56	488,761
(3.6 percent increase over 54-55)	
Expenditures 1956-57	545,747
(11.6 percent increase over 55-56)	
Expenditures 1957-58 (approx.)	620,179
(13.6 percent increase over 56-57)	

These increases reflect the need for the Division of Mines to continue to provide helpful and efficient services to the growing population of the state at a level set by public demand. The expenditures listed below

include increases in the costs of equipment, supplies, services, and salaries.

The second year of paid subscriptions to the monthly publication *Mineral Information Service* yielded $13,738, an abatement against the support expenditures for the Division.

Expenditures

Fiscal 1957-58

Total salaries and wages		$378,486.39
Operating expenses		
Freight, cartage and express	$1,318.74	
Telephone and telegraph	2,841.24	
Toll calls	573.99	
Light, heat and power	2,491.89	
Rent of building space	31,052.32	
Repairs and maintenance	519.40	
Office, supplies and services	5,704.91	
Postage	9,531.89	
Photography, supplies and services	1,137.71	
Blueprinting	896.11	
Printing, bulletins and maps	72,141.24	
Printing, general	2,415.98	
Technical reports (purchase)	6,400.00	
Auto operations	9,629.28	
Travel, in-state	17,691.49	
Travel, out-of-state	1,862.39	
Auto mileage	330.92	
Laboratory, supplies and services	5,190.07	
Premium on bonds	74.41	
Library, supplies and services	1,067.10	
Exhibits, supplies and services	305.71	
Expendable accountable equipment	499.39	
Total operating expenses		$173,676.18
Equipment		
Automobile (replacement)	$2,614.82	
Field	140.40	
Laboratory (replacement and additional)	3,227.51	
Office (replacement and additional)	4,064.48	
Miscellaneous replacements	173.71	
Miscellaneous additional	1,886.38	
Library	1,789.07	
Total equipment		$13,896.37
Other current expenses		
Geological exploration in cooperation with U. S. Geological Survey	$35,000.00	
Publication of colored state geologic map		
Rent	$500.00	
Lithographer	18,620.00	
	$19,120.00	
Total other current expenses		$54,120.00
Grand total expenditures		$620,178.94
Appropriation reimbursement: Sale of *Mineral Information Service*		13,738.00
Grand net total, current operations		$606,440.94

Public Information Service

Important contacts between the Division of Mines and the mining public are made through the public information section at our offices in San Francisco, Los Angeles, Sacramento, and Redding. This section of the staff handles personal interviews, telephone calls, and letters of inquiry on the mining industry and geology from all parts of California, the United States, and remote countries of the world.

Inquiries during the past year have centered around the mineral stockpile programs of the U. S. Government and the status of federal legislation affecting the mineral industry. The plans and long-range proposals for the mineral industry have been of especial concern to geologists and miners throughout the West.

All members of the Division technical staff are kept alert to new developments and changes of emphasis in the mining industry. This is accomplished by a plan of rotating assignments, whereby each staff member spends a part of one week each month in the information section.

These public contacts frequently lead to the initiation of new mining enterprises in the state, and contribute to the greater utilization of its mineral wealth. During fiscal year 1957-58 the Public Information Section of the Division rendered many types of service to the mineral industry as illustrated by the following typical examples:

Basic Geology. As a result of recent field mapping in Modoc County the Division was able to assist geologists of an oil company in the interpretation of their geophysical studies of the area. Reviewed geology of upper Pliocene lake beds near Dorris with company geologist. Outlined distribution of Ione formation to a prospector. Referred ceramics student to source material for preparing clay report. Provided geologic map data to mining exploration company, water district engineer, geologist of a co-operative agency, individuals, and other interested parties on many occasions.

Supplied oil-producing estate with geologic information on Edison oil field and possibilities of drainage and secondary recovery. Discussed with county planning commission the problems of establishing county regulations governing the geologic hazards at building sites. Prepared list of geological references on Santa Maria Valley area for an oil company representative. Provided engineering firm with geologic data on a clay-shale area about to be opened.

Identified fossils for geologists and collectors. Supplied large land company with geologic information on the area of their holdings.

Mining and Mineral Processing. Supplied concern engaged in study of Mojave Desert water needs with basic information on mining operations. Recommended method of exploring its mercury deposit to a small mining company. Advised interested party on economics of opening up a dimension stone quarry. Furnished data on water-flooding projects to company applying industrial control of micro-organisms. Provided U. S. Bureau of Mines with current information on uranium mining. Recommended California producer of fluorite as source of special-ground fluorite for experimental work. Discussed problem of mining building stone with potential retail stone dealer. Explained methods of upgrading manganese ore to small mine operators.

Assisted geologists in evaluating clay and diatomite deposits. Assisted a prospector attempting to develop a large, low-grade copper deposit. Outlined possibility of locating a faulted ore body during visit to a lead mine. Supplied mining history of a property to an investor considering reopening the deposit. Recommended course of future exploration to a gold miner while visiting his prospect. Pointed out favorable and unfavorable indications of a prospect to an inexperienced miner while examining his claims. Advised prospector regarding the amenability of mineral on his claim to upgrading treatment.

Provided insurance company with information on blasting power of various types of explosives. Discussed with a miner the steps necessary in proving and developing his claim. Supplied equipment company with information on quarries which might use their equipment. Directed miners seeking employment to active mines. Furnished information regarding mine buildings to insurance underwriter.

Supplied information on recovery methods and economic outlook for zirconium ore to owner of a placer deposit. Estimated number of persons engaged in chrome mining for county road department.

Raw Materials. A major cement company took an option on a large limestone deposit, based on information supplied by the Division. Supplied information on bentonite deposits to company representative. Discussed sources of perlite with a new producer of expanded perlite. Information on location of expanded shale deposits presented to interested firm. Supplied out-of-state company with information on Orange County clays. Outlined raw material sources to manufacturer of structural clay products. Provided oil company with coal samples from dated beds for research on spore analysis.

Directed company to local source of tough, abrasion-resistant rock for use in heavy-duty concrete floors. Pointed out sources of concrete aggregate to construction firms interested in U. S. Government works projects. Directed a construction company to sources of heavy aggregate for use in radioactive shielding.

Informed a cement company on the production, quality, and potential of sand and gravel resources in the Niles-Livermore area. Discussed mineral potential of a county with consultant making a survey for the county Board of Supervisors.

Furnished railroad company representative with estimate of sand and gravel reserves in northern California. Furnished data to a manufacturer on supplies of silica sand of particular specifications. Informed manufacturer of welding fluxes relative to sources of raw material. Directed Corps of Engineers, U. S. Army, to sources of riprap for use on breakwater project.

Assisted companies in locating sources of diatomite and silica sand for use in wax and new type of building material, respectively. Furnished engineers information on iron ore deposits suitable for sponge iron.

Physical and Chemical Data on Minerals and Rocks. Discussed application of differential thermal analysis procedures in prospecting with a consulting geologist. Supplied analyses of several limestone deposits to a cement company. Made an interpretation of chemical analysis of kaolin sample for owner of deposit. Advised federal geologist on location of specialized testing laboratories. Determined trans-

mission of ultraviolet light by muscovite sample for representative of roofing manufacturer. Identified rocks and minerals for prospectors, miners, engineers, and the general public.

Mineral Utilization and Marketing. Counselled new owner of a stone quarry on developing and marketing his stone. Advised prospector regarding raw materials requirements for structural clay products.

Supplied information on marketing limestone and dolomite to numerous companies and land owners. Informed deposit owner on requirements and specifications for paper clays and on other possible markets for clay production. Gave market information to potential producers of bentonite. Advised government geologist on market for imported marble.

Assisted company representative in gathering data on which to evaluate asbestos deposit. Reviewed marketing problems of pyrophyllite and suggested potential markets to a prospective producer. Suggested market outlets to a producer of cement copper. Discussed market for fluorspar importer. Assisted railroad company in classifying an extraordinary raw material for freight rate adjustment. Supplied explosives company with advice on possible markets for their product.

Suggested possible buyers to a mine operator making a zinc sulfide concentrate. Supplied many small mercury miners with list of buyers of the metal.

Miscellaneous Information. Appeared at State Fish and Game Commission land withdrawal hearings and requested action leading to abolition of restrictions on mineral location and mining in proposed withdrawal areas. Publications of the Division were used as source books in several court cases during the year. Informed a company on status of Sierran foothill reservoir sites. Informed company geologist on sources of special-purpose maps. Provided Sacramento Geological Society with geologic map for spring field trip. Appeared on radio program and answered questions on geology of earthquakes. Acted as panelist for group advising high school students on the advantages offered by the mining and geological professions.

Helped Burlingame Police Department locate stolen car by deducing place of abandonment from meager geological evidence. Furnished Air Force with data on long mine tunnels in California. Judged county mineral exhibits at State Fair. Discussed and explained claim holder responsibilities under Public Law 167 with property owner. Reviewed and offered suggestions to author revising gypsum chapter of book, Industrial Minerals and Rocks. Conducted numerous field trips for geologic societies and student groups.

Critically reviewed book on prospecting for fluorescent minerals for an author. Provided miner with information on nearest section corners to his mining property. Furnished U. S. Government engineers, State agency engineers, and consultants with all types of information on geology and the mining industry.

Public Appearances

The Division keeps alert to developments in the professions of geology and mining engineering by participating in the technical sessions of professional societies. This type of relationship with the industry

has been of great practical value to the state by securing for Division use the results of mineral investigations and research made by cooperating organizations and agencies. Several members of our technical staff have been honored by election to important offices and to fellowships in technical societies representing various professional fields, including mining, geology, petroleum exploration, geochemistry, and economic geology. Each year, a number of technical papers are presented by our mining geologists to technical meetings of such societies; for example, during 1957-58 two papers on California mineral resources were presented at Pacific Southwest Industrial Minerals Conference of the American Institute of Mining, Metallurgical, and Petroleum Engineers; two papers on California geology were presented to Cordilleran Section of the Geological Society of America; the geologic mapping program was described to the Association of American State Geologists; and the panel forum of American Ceramic Society was attended.

Staff mining geologists and administration of the Division frequently respond to direct requests of education groups, societies, and organizations for informative talks on the mineral industry, geologic subjects, mineralogy, and the services of the Division. Over 20 such illustrated talks were given to mineral societies during the year; several were given to public and private school classes; and several were given to local geological and mining societies composed of professional members, such as the Sacramento Geological Society, Peninsula Geological Society, and Mining Association of Southern California. Under appropriate circumstances, a Division geologist appearing at fairs, hobby shows, mineral societies, and professional conventions will display and sell publications; such sales were over $1,600 in 1957-58.

Special attention is paid to requests for lectures, counsel, and assistance to such groups as the Association of Outdoor Education, Boy Scouts of America, college geology classes, high school and elementary school groups, Sierra Club, and mineralogy classes.

Our participation and counsel is requested several times a year on such occasions as council meetings on State Recreation program, legislative hearings, hearings of Wildlife Withdrawals, and Conservation Education meetings. The Division administration presented a panel discussion of proposed field studies and research program of the Division to the Mineral Industries Section of the Commonwealth Club.

Summary of appearances	1957-58	1956-57
Total meetings represented	215	241
Active participation in	105	(Not totaled)
Talks presented	56	36
Publications sold at	16	14
Sales at meetings and shows	$1,630.31	$700

LIBRARY

The Division of Mines maintains a reference and research library for the use of the public and the professional staff. It is a comprehensive collection of materials in the earth sciences, with about 22,000 volumes, 300 current periodicals and newspapers, and 15,000 maps. A partial list of the subjects represented includes geology, paleontology, mineralogy, mining engineering, metallurgy, mineral economics, petro-

leum, chemistry and chemical technology, and water resources. Western exploration and travel, California state and local history, the gold rush and early period of gold mining are well represented. The library is a complete depository for publications of the U. S. Geological Survey and U. S. Bureau of Mines and state surveys, and has extensive holdings of the publications of the major professional societies in geology and mining.

Current economic and research developments in many parts of the world are made available through an exchange program with institutions in 48 countries. During the past year particular attention has been directed to the output of Russian scientific publications. The Library's file of Russian materials includes several years of the geological series and other monographic studies of the Academy of Sciences of the U.S.S.R., and there are important holdings of publications from Poland, Czechoslovakia, and other eastern European countries from about 1950. This year new exchanges were arranged with geological surveys or other official government agencies in Argentina, Austria, England, Nicaragua and Southern Rhodesia, and with universities and research institutions in Canada, New Zealand, Wales, and Yugoslavia.

Activities of the Library in terms of the number of references to books and periodicals by patrons, members of the public as well as staff, continued at the high level reached in the previous 2 years. Correspondence for the year continued to increase, much of it in connection with the distribution of Division of Mines publications to school and college, and public libraries within the state. In response to requests for materials, a total of 1,800 publications, as well as 95 sets of a selected group known as the school library kit were distributed. This was in addition to regular mailings to the depository list which includes most of the college and university libraries, the county and large public libraries, and many high school and district teachers' libraries in California.

This report is accompanied by a list of classified books added to the collection. An important reference set not shown in the list is the 15-volume *Encyclopedia of Chemical Technology*, by Kirk and Othmer. The first 17 volumes of the Sierra Club Bulletin were acquired, completing our file—a gift, with other publications, from the Sierra Club Library. Mr. S. M. French of San Francisco was the donor of a group of books. A file of 33 volumes of the publications of the Scripps Institution of Oceanography was acquired by exchange. From the Twentieth International Geological Congress, Mexico City, 21 volumes and a geologic map of Mexico were received.

Miscellaneous Geologic Maps and Charts. Miscellaneous geologic maps and charts, published by the U. S. Geological Survey, are regularly received and added to the Division's Library collection. These include: geologic quadrangle maps, oil and gas investigations, coal investigations, mineral investigations field studies maps, mineral investigations resource appraisal maps, index maps for each state showing location of published geologic maps, and miscellaneous geologic investigations maps. During the last fiscal year the Division received and filed 218 maps of this category. The Library maintains a complete file of topographic maps of California available for the use of Library patrons.

Books Added to Library During Fiscal Year 1957-58

Advances in geophysics. Vol. 3. New York, Academic Press, 1956.

American Assembly. Atoms for power; United States policy in atomic energy development. New York, Columbia University, 1957.

American Association of Petroleum Geologists. Comprehensive index of the publications, 1946-1955. Tulsa, 1957.

American Association of Petroleum Geologists. A guide to the geology and oil fields of the Los Angeles and Ventura regions. For annual meeting A.A.P.G.-S.E.P.M. Los Angeles, 1958.

American Bureau of Metal Statistics. Year book. 37th annual ed. New York, 1958.

American Ceramic Society. Indexes to publications. Journal, 1918-1955. Bulletin, 1922-1955. Columbus, 1957.

American Gas Association. Gas facts; a statistical record of the gas utility industry in the United States. New York, 1957.

American Institute of Physics handbook. New York, McGraw-Hill, 1957.

American Mutual Liability Insurance Company. Surface construction without accidents. Boston, 1946.

American Society for Testing Materials. Methods for emission spectrochemical analysis. Philadelphia, 1957.

American Society for Testing Materials. Symposium on titanium. Philadelphia, 1957.

Arizona Development Board. Arizona's natural resources, a review. Phoenix, 1957.

Ayres, Eugene. Energy sources, the wealth of the world. New York, McGraw-Hill, 1952.

Azároff, Leonid V. The powder method in X-ray crystallography. New York, McGraw-Hill, 1958.

Badger, Walter Lucius. Introduction to chemical engineering. New York, McGraw-Hill, 1955.

Barnes, Virgil E. Eastern Llano region. Field excursion, Association of American State Geologists annual meeting. Austin, University of Texas, Bureau of Economic Geology, 1958.

Barzun, Jacques. The modern researcher. New York, Harcourt, Brace, 1957.

Bathurst, Effie Geneva. Conservation experiences for children. Washington, U. S. Office of Education, 1957.

Beatty, William B. Sources of information on geology and mining in the western states. Menlo Park, Stanford Research Institute, 1957.

Betteridge, Harold T., ed. The new Cassell's German dictionary, German-English, English-German. New York, Funk & Wagnalls, 1958.

Boron, calcium, columbium, and zirconium in iron and steel. New York, Published for the Engineering Foundation by J. Wiley, 1957.

Boy Scouts of America. Merit Badge Series. Geology. Prepared by a committee of the American Association of Petroleum Geologists. New Brunswick, N. J., 1953.

Brandon, William. The men and the mountain; Frémont's fourth expedition. New York, Morrow, 1955.

Brown, Harrison Scott. The next hundred years: man's natural and technological resources; a discussion. New York, Viking Press, 1957.

Buehr, Walter. Underground riches; the story of mining. New York, Morrow, 1958.

Burcham, Lee T. California range land; an historico-ecological study of the range resource of California. Sacramento, Division of Forestry, 1957.

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TOPOGRAPHIC MAPS

One hundred ninety-eight newly completed U. S. Geological Survey topographic maps of California were received during the 1957-58 fiscal year, and during the same interval, 129 advance sheets were reviewed. This large number of new maps helps to reduce the number of unmapped, or insufficiently mapped, areas in California so that in the next few years it is expected that the whole state will be covered by suitable topographic maps on at least the 15-minute scale. The task will not be finished then, however, for the continual task of keeping the maps up-to-date is a never-ending one and one of gargantuan proportions. This work, performed by the Topographic Branch of the U. S. Geological Survey, with cooperating funds from the State of California, through the Department of Water Resources, is of vast importance to geologists and engineers because accurate topographic maps are essential to all geologic and ore deposit studies.

As topographic maps are used constantly by the staff of the Division of Mines, a complete file of quadrangles, including a reserve stock, is maintained in the Headquarters office. These maps are available for public inspection at the headquarters or branch offices. The library in the San Francisco office maintains a complete file of cloth-mounted maps specifically for reference use by the general public.

The Division receives 16 copies of each newly published topographic quadrangle map of areas in California. The State Department of Water Resources provides the Division with 10 copies, while an additional 6 are sent directly from the U. S. Geological Survey. Advance prints of California quadrangles (subject to correction) are received from the U. S. Geological Survey for our inspection and comment before the final map is printed. The Division also receives from the Survey one copy of each new quadrangle map covering areas in other western states.

1957-58 fiscal year topographic map receipts.

Newly completed quadrangles (California)	199
Advance proof sheets (California)	129
Newly completed quadrangles (other western states)	957

The fine support the Division receives from both the U. S. Geological Survey and the State Department of Water Resources is much appreciated. The new topographic quadrangle maps made available to the public are announced in the Division's *Mineral Information Service.*

ORE-BUYERS INSPECTION

The Division of Mines, under the Ore-Buyers License Act, Chapters 2250 to 2275 inclusive of the Public Resources Code, Division II, issues licenses annually to any person, or association of persons purchasing gold in any form for resale.

Nineteen unlimited licenses, allowing purchases of $1,000 or more, and 42 limited licenses, allowing purchases of less than $1,000, were issued during the fiscal year. This is an increase of five over the last fiscal year.

The records and activities of each licensee are inspected for any violations of this act several times a year by our Ore-Buyers Inspector.

PUBLICATIONS OF THE DIVISION OF MINES

The Division of mines publishes results of its field and laboratory investigations and research through four types of publications: *Mineral Information Service, California Journal of Mines and Geology,* Bulletin series, and the Special Report series. *Mineral Information Service* is a monthly 8-page pamphlet which features informative articles on the geology and mineral resources of California and serves as a news release on mineral discoveries, mining operations, markets, statistics, and new publications. The quarterly *Journal* carries inventory reports, articles on mineral commodities, and short papers on other subjects, but is currently the outlet for publication of the important reports on mines, mineral resources, and geology of the state by counties. The Bulletin series is used for reports on the geology and mineral resources of quadrangles, for state-wide commodity studies, and for the popular geologic guidebooks. Special Reports are published from time to time and are a convenient medium for a wide variety of technical articles related to the basic geology and mineral resources of the state.

In past years, a very large proportion of the material published by the Division has been contributed by outside authors through cooperative arrangements. This continues to be a most important source of information for publication, but in the last 2 years the Division's staff of mining geologists has brought a number of projects to completion, with the result that most of the 1957-58 publications are by Division of Mines authors. Bulletin 175, *Salt in California*, is a review of the salt

PHOTO 4 (next page). Permanente Cement Company's new cement plant in desert area near Lucerne Valley, San Bernardino County, described in the January 1958 issue of *Mineral Information Service. Photo courtesy Permanente Cement Co.*

industry in the state, from geologic origin and occurrence to marketing, by mining geologist William E. Ver Planck. Bulletin 176, *Mineral commodities of California*, edited by staff geologist Lauren A. Wright, is a 736-page, quarto-sized volume in which Division authors present a comprehensive study of California's mineral resources by commodities, emphasizing their geologic occurrence, economic development, and utilization. Special Report 52, published during the year, is an extremely useful *Index to geologic maps of California published to December 31, 1956*, by staff geologists R. G. Strand, J. B. Koenig, and C. W. Jennings. This is a by-product of the state geologic map project, for which it was necessary to consult and evaluate geologic maps of all parts of California. It is a basic reference for all concerned with the geologic features of any part of the state.

All of the following reports, issued or in press during fiscal 1957-58, are by members of the California Division of Mines, with the exception of those marked (BM), member of the U. S. Bureau of Mines; (BR), member of U. S. Bureau of Reclamation; (C), consultant, or member of a commercial firm; (GS), member of the U. S. Geological Survey; (U) member of a university faculty, or graduate student.

Publications Issued During Fiscal Year 1957-58

Mineral Information Service

Vol. 10, No. 7, July 1957: Aluminum; New reports on Bishop district; Mercury purchase program extended; Dimension stone production increasing.

Vol. 10, No. 8, August 1957: Elementary placer mining methods; Bradley, Browning reappointed to S.M.B.; Tidelands oil bill signed; New issue of Journal; Mercury production in 1956; Goodwin leaves staff; New geologic map of Oakland; Geophysical map of Los Angeles Basin; Report on Santa Ana Mountains; Maps of cities available; Recommendations for a national minerals policy; Sixth clay conference; References on selenium; West Shasta copper-zinc district; Mojave Desert saline deposits; San Francisco water; Mariposa County scenes.

Vol. 10, No. 9, September 1957: Bishop district, California; Proposed wildlife land withdrawals; Rare mineral found in California; "Minerals of California" supply low; New California topographic maps.

Vol. 10, No. 10, October 1957: Boron; Proposed wildlife withdrawal.

Vol. 10, No. 11, November 1957: Mercury; Oil progress week; BSA geology merit badge; Calendar; Supplement, Available publications, California Division of Mines, November 1957.

Vol. 10, No. 12, December 1957: Changing gold into mercury; Index to Mineral Information Service, volumes 1 to 10, 1948 to 1957; DMEA contracts in California; New list of available publications of Division of Mines now ready for distribution; Tax decisions; New land open to location.

Vol. 11, No. 1, January 1958: Mineral production review, California, 1957; Mineral production by counties, 1956; California mineral production by commodity groups; California mineral production in 1956; Mineral production by counties, 1956; Permanente Cement Company plant; Mineral market quotations; California Landscape reprinted.

Vol. 11, No. 2, February 1958: Olaf P. Jenkins, Chief, Division of Mines, retires; Plan and progress of state geologic map; New book on gem materials; New edition of "Mineral commodities of California" now available.

Vol. 11, No. 3, March 1958: Petroleum in California; American Association of Petroleum Geologists to meet in March; New phone number for S. F. office of Division of Mines.

Photo 5 (preceding page). Half Dome in Yosemite Valley, scenic wonderland of Mariposa County. Mines and mineral resources of the county are described in the January-April 1957 issue of the *California Journal of Mines and Geology. Photo by Mary Hill.*

Vol. 11, No. 4, April 1958: Potash; New supply of Bulletin 173; Oakeshott to head Division; Recording fee changed; Field trip logs; O. P. Jenkins honored; New exhibit of fossils.

Vol. 11, No. 5, May 1958: Sulfur and pyrites; Cement in 1957; New German book; Mineral commodities of California; New issue of Journal.

Vol. 11, No. 6, June 1958: Gem stones; Eocene conglomerate yields sand and gravel.

California Journal of Mines and Geology

Vol. 53, Nos. 1 and 2, January-April 1957: Geology of the Island Mountain Copper mine, Trinity County, California, by Melvin C. Stinson; Mines and mineral deposits of Mariposa County, California, by Oliver E. Bowen Jr. and Cliffton H. Gray Jr.

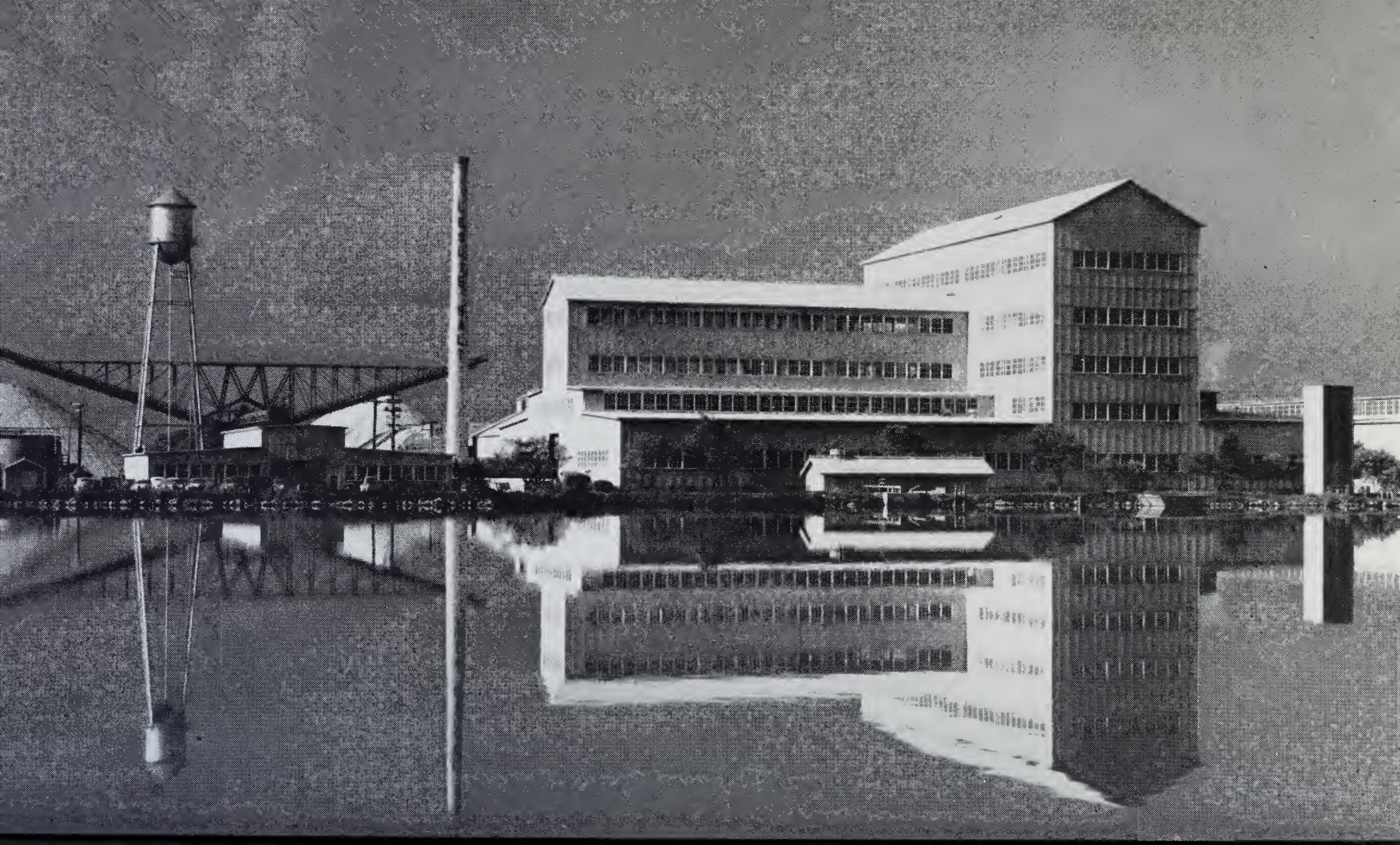
Vol. 53, Nos. 3 and 4, July-October 1957: Lead and zinc in California, by J. Grant Goodwin; Outline geologic map of California showing locations of mines with lead and zinc production (Economic mineral map of California No. 7—Lead and zinc), by J. Grant Goodwin.

Vol. 54, No. 1, January 1958: Annual report of the State Mineralogist, Chief of the Division of Mines, for the 108th fiscal year, July 1, 1956 to June 30, 1957, by Olaf P. Jenkins; California mineral commodities in 1955 and 1954, by Henry H. Symons and Fenelon F. Davis; Metal and mineral review for 1956, by Charles W. Merrill et al. (BM).

Bulletins

Bulletin 175, Salt in California, by William E. Ver Planck.

Bulletin 176, Mineral commodities of California, containing: Natural environment of the mineral resources of California, by Olaf P. Jenkins; Abrasives, by Bennie W. Troxel; Aluminum, by George B. Cleveland; Antimony, by Harold B. Goldman; Arsenic, by J. Grant Goodwin; Asbestos, by Salem J. Rice; Asphalt and bituminous rock, by Charles W. Jennings; Barite, by Charles J. Kundert; Beryllium, by Lauren A. Wright; Bismuth, by Charles W. Chesterman; Black sands, by Melvin C. Stinson; Boron, by William E. Ver Planck; Bromine, by William E. Ver Planck; Cadmium, by J. Grant Goodwin; Calcite (optical grade), by Lauren A. Wright; Calcium chloride, by William E. Ver Planck; Carbon dioxide, by Harold B. Goldman; Cement, by Oliver E. Bowen Jr.; Chromite, by Salem J. Rice; Clay, by George B. Cleveland; Coal, by Charles W. Jennings; Cobalt, by Charles W. Chesterman; Copper, by J. C. O'Brien; Diatomite, by Gordon B. Oakeshott; Feldspar, by Lauren A. Wright; Fluorspar, by Charles W. Chesterman; Gem stones, by Lauren A. Wright; Gold, by William B. Clark; Graphite, by Gordon B. Oakeshott; Gypsum, by William E. Ver Planck; Iodine, by William E. Ver Planck; Iron industries, by Thomas E. Gay Jr.; Kyanite, andalusite, and related minerals, by Lauren A. Wright; Lead, by Richard M. Stewart; Limestone, dolomite, and lime products, by Oliver E. Bowen Jr.; Lithium and lithium compounds, by William E. Ver Planck; Magnesium, and magnesium compounds, by William E. Ver Planck; Manganese, by Fenelon F. Davis; Mercury, by Fenelon F. Davis; Mica, by Lauren A. Wright; Minor metals, by J. Grant Goodwin; Molybdenum, by Richard M. Stewart; Natural gas, by Earl W. Hart; Natural-gas liquids, by Earl W. Hart; Nickel, by Salem J. Rice; Nitrogen compounds, by William E. Ver Planck; Peat, by Charles W. Jennings; Petroleum, by Charles W. Jennings; Phosphates, by Charles J. Kundert; Platinum and allied metals, by William B. Clark; Pumice, pumicite, perlite, and volcanic cinders, by Charles W. Chesterman; Pyrites, by Charles W. Chesterman; Pyrophyllite, by Lauren A. Wright; Quartz crystal (electronic grade), by Lauren A. Wright; Quartzite and quartz, by William B. Clark and Denton W. Carlson; Rare earth elements, by Lloyd C. Pray (C); Salines, by William E. Ver Planck; Salt, by William E. Ver Planck; Sand and gravel, by Thomas E. Gay Jr.; Shale, expansible, by B. H. Rogers and Charles W. Chesterman; Silver, by Richard M. Stewart; Sodium carbonate, by William E. Ver Planck; Sodium sulfate, by William E. Ver Planck; Specialty sands, by Thomas E. Gay Jr.; Stone, crushed and broken, by Thomas E. Gay Jr.; Stone, dimension, by Harold B. Goldman; Strontium minerals, by William E. Ver Planck; Sulfur and sulfuric acid, by Philip A. Lydon; Talc and soapstone, by Lauren A. Wright; Thorium, by Bennie W. Troxel; Tin, by Cliffton H. Gray Jr.; Titanium, by Philip A. Lydon; Tungsten, by Richard M. Stewart; Uranium, by Bennie W. Troxel, Melvin C. Stinson, and Charles W. Chesterman; Vanadium, by Melvin C. Stinson; Wollastonite, by Bennie W. Troxel; Zinc, by J. C. O'Brien; Zirconium and hafnium, by Melvin C. Stinson; Index.



Special Reports

Special Report 52, Index to geologic maps of California to December 31, 1956, by R. G. Strand, J. B. Koenig, and C. W. Jennings.

Publications in Press at Close of Fiscal Year 1957-58

Mineral Information Service

Vol. 11, No. 7, July 1958: Salt; More aggregate to be used; Kennedy mine tailing wheels; Logs of desert cores on file; New edition of *Suggestions to Survey Authors* published; New book on salt.

California Journal of Mines and Geology

Vol. 54, No. 2, April 1958: Effect of clay-mineral composition on strength of central-California sediments, by Robert B. Langston (U), Parker D. Trask (U), and Joseph A. Pask (U); Sand and gravel resources of Cache Creek in Lake, Colusa, and Yolo Counties, by Ira E. Klein (BR) and Harold B. Goldman.

Vol. 54, No. 3, July 1958: Poverty Hills diatomaceous earth deposit, Inyo County, California, by George B. Cleveland; Mines and mineral resources of Tulare County, California, by J. Grant Goodwin.

Bulletins

Bulletin 146, Geology of Lake Elsinore quadrangle, California, by Rene Engel (C), Mineral deposits of Lake Elsinore quadrangle, California, by Rene Engel (C), Thomas E. Gay Jr., and B. L. Rogers.

Bulletin 172, Geology of the San Fernando quadrangle, California, by Gordon B. Oakeshott.

Special Reports

Special Report 50, Plants as a guide to mineralization, by Donald Carlisle (U) and George B. Cleveland.

Special Report 51, Economic geology of the Darwin quadrangle, Inyo County, California, by Wayne E. Hall (GS) and E. M. Mackevett (GS); includes Darwin silver-lead district, by W. E. Hall (GS), E. M. Mackevett (GS), and D. L. Davis (GS), and Tungsten deposits, by W. E. Hall (GS), E. M. Mackevett (GS), and D. M. Lemmon (GS).

Special Report 54, Age determination of some granitic rocks in California by the potassium-argon method, by G. H. Curtis (U), J. F. Evernden (U), and J. Lipson (U).

INVENTORIES OF MINING ACTIVITIES AND COUNTY RESOURCES REPORTS

The county report in published form is the end product of one of the most important activities of the Division of Mines. It is an inventory survey which summarizes all pertinent information on a county's mineral resources, including ownership of the individual deposits, nature of the deposits, history of the mining operations, and current status. Photographs, charts, mine maps, planimetric maps of the county showing locations of mineral deposits, and geologic maps assist in the presentation of the facts. The county report is one of the most commonly requested types of Division of Mines publications.

Changes in the state's industrial pattern involve changes in the use pattern of raw mineral materials. Such conditions place added emphasis upon the need for up-to-date inventory reports, and the Division of Mines continues to apply a considerable portion of staff time on county report projects.

PHOTO 6 (opposite page). Leslie Salt Co. refinery at Newark, Alameda County, described in Bulletin 175, *Salt in California*, which was issued during fiscal 1957-58. *Photo by Will Smith, courtesy Leslie Salt Co.*

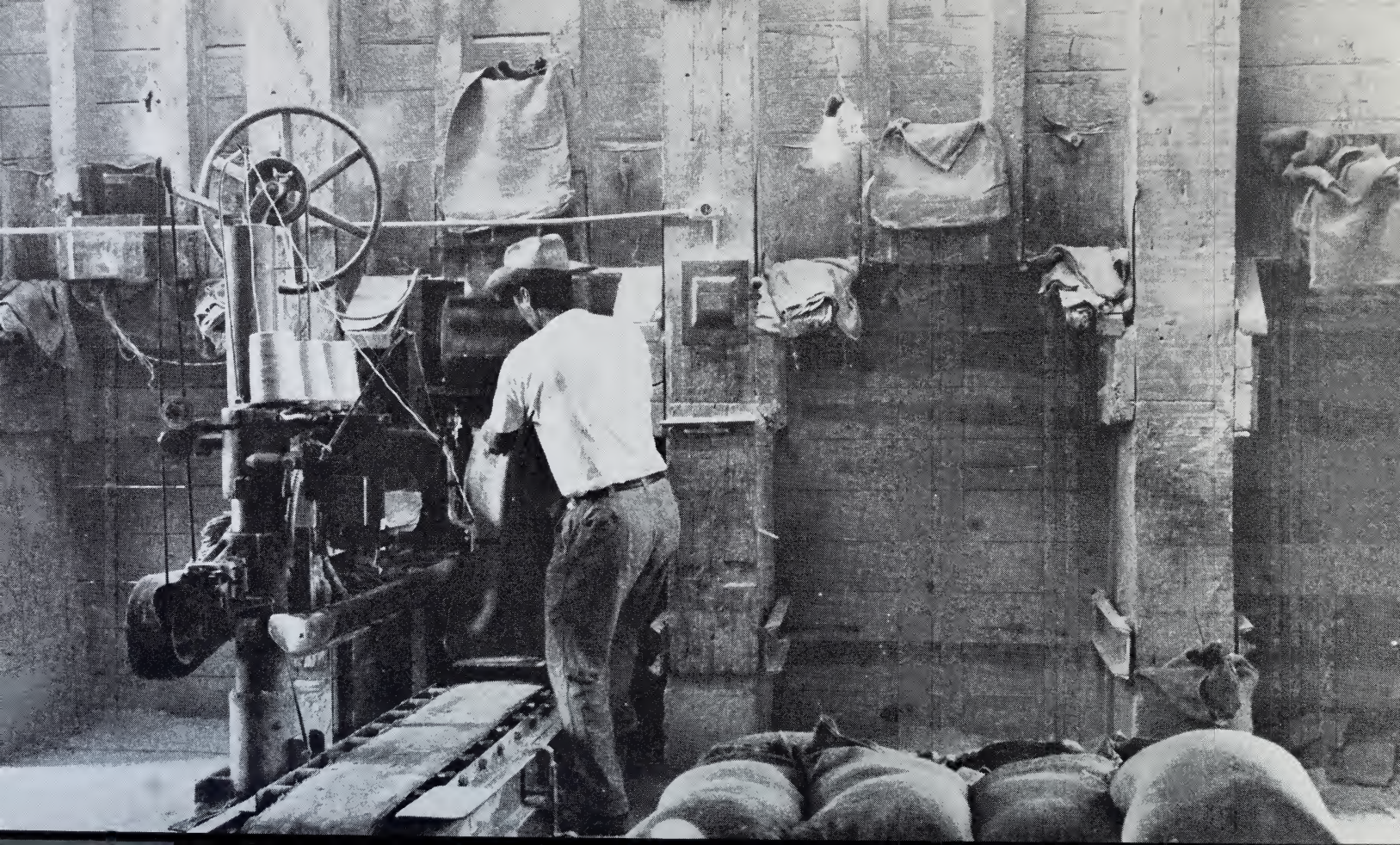


PHOTO 7 (page 44). Sacking marble terrazzo granules at plant of Sonora Marble Aggregates Company near Sonora, Tuolumne County. This is one of the many operations described in Bulletin 176, *Mineral Commodities of California*, issued during fiscal 1957-58. Bulletin 176 summarizes the mineralogy, general geology, California occurrences, mining methods, treatment, utilization, marketing, and prices of some 80-odd mineral commodities. *Photo by Mary Hill.*

PHOTO 8 (page 45). Darwin mines, shown in this photo, are described in Special Report 51, *Economic Geology of the Darwin Quadrangle*, in press at end of fiscal 1957-58. *Photo by Mary Hill.*

PHOTO 9 (opposite). Butte near Success, Tulare County. Mines and mineral resources of the county are described in the July 1958 *California Journal of Mines and Geology*, in press at the close of the fiscal year. *Photo by Mary Hill.*

County reports are published in the quarterly *California Journal of Mines and Geology*. News items and shorter reviews of mining activities are published in *Mineral Information Service*. Occasionally, more detailed studies of mineralized districts are required. These may be published in the *Journal*, or in the Special Report or the Bulletin series.

During the fiscal year 1957-58, no county reports were published. However, the commodity reports *Lead and zinc in California*, and *Sand and gravel resources of Cache Creek in Lake, Colusa, and Yolo Counties* were published in the July-October 1957 and April 1958 issues, respectively, of the *California Journal of Mines and Geology*. Editing of reports on Tulare and Contra Costa Counties was completed, and both reports were scheduled for early publication in that order. A report on Shasta County was revised after the first editorial review and was resubmitted for final review and publication. A report on Calaveras County was completed and submitted for the first editorial review. Work was in progress on assigned reports for Alameda, Kern, Modoc, Monterey, Orange, Riverside, San Diego, and Trinity Counties.

The October 1957 issue of *Mineral Information Service* contained a brief reference to the mineral resources of several areas that were the subjects of proposed federal Wildlife Withdrawals. The areas described were the New Idria area in San Benito and Fresno Counties, McCain Valley area in San Diego County, and Mt. Dome area in Siskiyou County.

Progress made by staff members on county inventory reports is summarized below:

Alameda County: Compiled data on sources of rock, sand, and gravel. Field studies and tabulation of all mineral deposits started. Geologic map in preparation.

Calaveras County: Completed and being edited.

Contra Costa County: Completed and being edited.

Kern County: Contributions by commodity specialists on rock, sand and gravel, salines, petroleum, and limestone nearly completed. First draft of manuscript on the county scheduled for completion October 1958.

Modoc County: Visited mining operations and mineral deposits. Geologic studies nearly completed as part of Alturas geologic map sheet project.

Monterey County: Bibliography and preliminary list of mines prepared from published sources. Limestone deposits visited. Geologic studies in progress.

Orange County: Properties visited and field review of geologic features made.

Riverside County: Mining properties visited and data indexed.

San Diego County: Field examination of mining properties nearly completed. Areal map of Ramona pegmatites prepared. Completed field study of sand and gravel resources and prepared preliminary write-up.

Shasta County: Field work and report completed.

Trinity County: Visited mining operations and mineral deposits.

The availability of county reports in the *California Journal of Mines and Geology* is shown in the list below. The status of out-of-print reports is shown by the explanatory notes.

Alameda	April 1950[a]	Orange	January 1925[a]
Alpine	October 1931	Placer	July 1927[b]
Amador	January 1954[d]	Plumas	April 1937[b]
Butte	July 1949	Riverside	July 1945[a]
Calaveras	July 1936[c]	Sacramento	April 1955
Colusa	July 1929	San Benito	January 1947
Contra Costa	October 1951[c]	San Bernardino	January-April 1953
Del Norte	October 1952	San Diego	January 1939[a]
El Dorado	October 1956[d]	San Francisco	April 1929[b]
Fresno	July 1951	San Joaquin	January 1955
Glenn	January 1952[b]	San Luis Obispo	October 1935[b]
Humboldt	October 1941	San Mateo	October 1955[d]
Imperial	April 1942[b]	Santa Barbara	October 1925[b]
Inyo	January 1951	Santa Clara	April 1954[d]
Kern	April 1949[a]	Santa Cruz	January 1943
Kings	July 1953	Shasta	April 1939**
Lake	January 1947	Sierra	January 1942
Lassen	October 1936	Siskiyou	October 1947
Los Angeles	July-October 1954	Solano	April 1927
Madera	October 1950	Sonoma	January 1950
Marin	July 1955	Stanislaus	April 1947
Mariposa	January-April 1957	Sutter	1920[b]
Mendocino	October 1953	Tehama	July 1946[b]
Merced	July 1952	Trinity	January 1941[a]
Modoc	October 1936*	Tulare	October 1930[c]
Mono	April 1940	Tuolumne	January 1949
Monterey	January 1925[a]	Ventura	July-October 1932[b]
Napa	April 1948	Yolo	July 1950
Nevada	July 1941	Yuba	April 1952[b]

* Report available but new report assigned and work in progress.
** Report available but new report completed for early publication.

Out of print publications
[a] New report assigned and in progress.
[b] No assignment.
[c] New report completed for early publication.
[d] This report scheduled for early reprinting.

BASIC GEOLOGIC MAPPING

The basic geologic mapping program is carried on predominantly on a quadrangle basis, although some special project work covers areas of irregular shape. Mapping is done by members of the Division staff, professors and graduate students affiliated with the universities, the staff of the U. S. Geological Survey (on a cooperative basis), exploration departments of private companies, and independent geologists.

Quadrangle mapping actively in progress by Division of Mines staff geologists include: the San Fernando 15-minute quadrangle, by Gordon B. Oakeshott, now in press; Matterhorn Peak 15-minute quadrangle, by Charles W. Chesterman, field mapping completed, report

in preparation; Bodie 15-minute sheet by the same author, mapping in progress; Shoshone 15-minute and south half of the Tecopa 15-minute quadrangles, by Lauren A. Wright, Bennie W. Troxel, and Charles W. Chesterman, field mapping in progress; Hernandez Valley 15-minute quadrangle, by Charles W. Jennings, field mapping nearly completed; Monterey and El Portal 15-minute quadrangles and east one-half of the Coulterville 15-minute quadrangle, by Oliver E. Bowen Jr., field work on each project 30 percent completed; Corona South 7½-minute sheet, by Cliffton H. Gray Jr., map and report completed; Shadow Mountain 7½-minute quadrangle, by Bennie W. Troxel, map and report completed; south half of Mt. Abbot quadrangle, by Philip A. Lydon, map and report in progress; Kaiser Peak quadrangle, by the same author, field work in progress; Joaquin Rocks 15-minute quadrangle, by Frederic R. Kelley, field work in progress; Haiwee Reservoir and Chilcoot 15-minute quadrangles, by Melvin C. Stinson, field work in progress; Coffee Creek 15-minute quadrangle, by Thomas E. Gay Jr., field work in progress; Greenwood 7½-minute quadrangle, by William B. Clark, field work in progress.

In addition to the quadrangle mapping program, reconnaissance mapping has been undertaken in many parts of the state to assist in preparation of the new state geologic map. Areas in which the geology had been previously lacking or for which existing geologic maps badly needed modification have received attention, as follows:

Death Valley map sheet: Parts of Bennetts Well, Big Dune, Chloride Cliff, Eagle Mountain, Ryan, and Telescope Peak quadrangles, and an unnamed quadrangle east of Eagle Mountain; parts of Keeler and Maturango Peak quadrangles.

Kingman map sheet: Parts of Clark Mountain, Horse Thief Spring, Kingston Wash, and Shenandoah Peak quadrangles; parts of Davis Dam and Horner Mountain quadrangles.

Needles map sheet: Parts of Cadiz, Colton Well, and Darby quadrangles.

San Diego map sheet: Parts of El Cajon, Jamul, and Poway Valley quadrangles.

Trona Map sheet: Part of the Silurian Hills quadrangle.

Bakersfield map sheet: Parts of Glennville and California Hot Springs quadrangles.

Fresno map sheet: Part of Camp Nelson quadrangle.

Ukiah map sheet: Part of Bartlett Springs quadrangle.

Alturas map sheet: Most of the eastern third of the map has been completed and all of remaining areas for which there were no pre-existing maps.

Westwood map sheet: The extreme northern fringe has been mapped and the northeastern quarter and other hitherto unmapped areas are in progress.

The following list and index map show the status of the basic geologic mapping program to July 1, 1958. Only those quadrangles which the State Division of Mines has published, which are in press or are being edited for publication, are listed. Quadrangles, or portions of quadrangles which are currently being prepared by Division of Mines personnel are listed separately. The quadrangles listed are 15-minute (scale 1:62,500), unless otherwise indicated. The letter preceding the name of the quadrangle indicates the affiliations of the geologists who are doing the work:

D—Division of Mines
U—University geologist
S—Federal Geological Survey
(cooperative program)
O—Other professional geologist

The symbol (example, H-15) following the quadrangle name serves as a means of locating it on the accompanying index map.

Recently published geologic map and report:

S	Angels Camp 7½ min.	P-16
U	Antioch	K-16
D	Barstow 30 min.	C′-29, C′-30, D′-29, D′-30
S	Big Pine	Y-20
S	Bishop	Y-19
U	Blue Lake	C-5
O	Breckenridge Mt.	X-27
S	Calaveritas 7½ min.	P-16
U	Carquinez	J-16
S	Casa Diablo Mt.	X-18
S	Cuyamaca Peak	F′-37
U	Ferndale	A-6
U	Fortuna	B-6
O	Gaviota	R-31
U	Healdsburg	G-14
U	Jamesburg	L-23
U	Lebec 7½ min.	W-29
O	Lompoc	Q-30
O	Los Olivos	R-30
U	Lower Lake	H-13
U	Macdoel 30 min.	I-1, I-2, J-1, J-2
U	Mare Island	I-16
U	Mount Vaca	J-15
S	Mt. Goddard, NE¼	X-20
S	Mt. Tom	X-19
S	Neenach	X-29
U	Ortigalita Peak	O-21
U	Petaluma	H-16
O	Point Arguello	P-30
O	Point Conception	Q-31
U	Point Reyes	G-16
U	Quien Sabe	N-21
O	Saltdale	A′-27
U	San Benito	N-22
U	San Jose, E½-Mt. Hamilton, W½	KL-19
U	San Juan Bautista	L-21
U	Santa Rosa	H-15
U	Sebastopol	G-15
U	Sonoma	I-15
S	Sonora 7½ min.	Q-17
U	Tesla	L-18
U	Vacaville	K-15

Geologic map only published:

U	Copperopolis	P-17
U	Hollister	M-21

Geologic map and report in press or being edited:

S	Darwin	B′-23
O	Lake Elsinore	C′-34
D	San Fernando	Y-31
U	Santa Ysabel	F′-36

Geologic mapping in progress by Division of Mines staff:

D	Avawatz Pass, N½	G′-26
D	Bodie	V-16
D & U	Chilcoot	R-9
D	Corona South 7½ min.	B-33
D	El Portal	S-18
D	Greenwood	O-13
D	Haiwee Reservoir	A′-24
D & U	Hernandez Valley	O-23
D	Joaquin Rocks	Q-23
D	Kaiser Peak	V-19
D & O	Masonic Mt.	V-15
D	Matterhorn Peak	U-16
D	Monterey	K-22
D	Mt. Abbot, S½	W-19
D & U	Shadow Mts. 7½ min.	B′-30
D	Shoshone	G′-25
D	Tecopa, S½	H′-25

STATE GEOLOGIC MAP, SCALE 1:250,000

The first two sheets of the new state geologic map are now in press. At the close of the 1957-58 fiscal year, the Death Valley and Alturas sheets were completed and sent to the lithographer for colored reproduction. These sheets are the first of the series of 25 sheets in the 4-year program to revise the state geologic map of California.

The new state geologic map, named the Olaf P. Jenkins edition, is being compiled on 1:250,000-scale Army Map Service base maps (1 inch equals 4 miles). This is twice the scale of the 1938 edition, which has now been out-of-print for 6 years. Most of the new geologic map sheets are 1 degree of latitude by 2 degrees of longitude, and will be about 18 by 27 inches.

The new edition incorporates the large amount of geologic mapping completed since the 1938 edition was published. The importance and usefulness of geologic mapping as a basic tool is realized more today than ever before, and is reflected by the increasing number of published reports containing geologic maps. This is graphically portrayed in the accompanying diagram showing the progress of geologic mapping in California from 1850 to 1957.

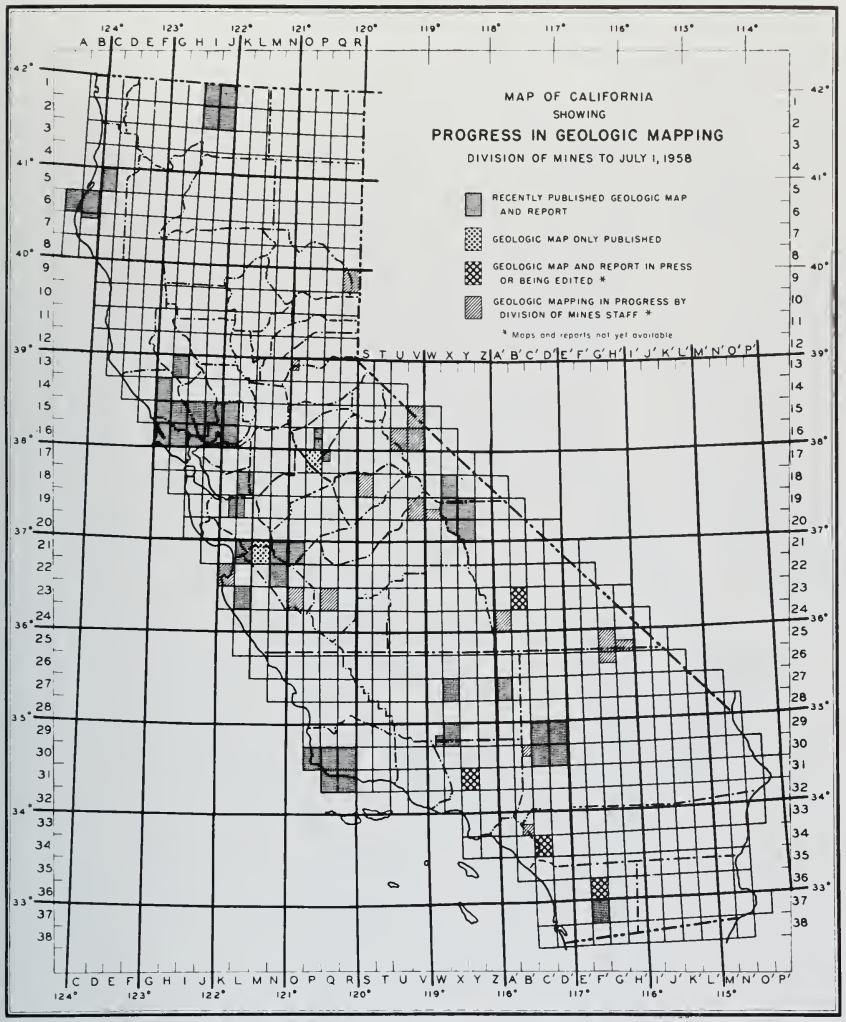

MAP OF CALIFORNIA
SHOWING
PROGRESS IN GEOLOGIC MAPPING
DIVISION OF MINES TO JULY 1, 1958
RECENTLY PUBLISHED GEOLOGIC MAP AND REPORT
GEOLOGIC MAP ONLY PUBLISHED
GEOLOGIC MAP AND REPORT IN PRESS OR BEING EDITED *
GEOLOGIC MAPPING IN PROGRESS BY DIVISION OF MINES STAFF *
* Maps and reports not yet available

FIGURE 3.

In 1955, eight sheets covering areas in southern California were published as a preliminary, uncolored edition. These eight sheets, available for $1.00 each, include Los Angeles, Long Beach, Santa Maria, Bakersfield, Santa Ana, Trona, Death Valley, and San Luis Obispo. Many suggestions and new data have been received since their publication, and these will be used in the revised colored edition.

Since these preliminary sheets were published, the Army Map Service and U. S. Geological Survey have undertaken a program of revising the 1:250,000-scale topographic maps. The new colored edition of the state geologic map is being compiled on these revised maps, and all previous compilations of geology on earlier sheets must be recompiled in order to fit properly the new topographic base. The new base maps are vastly more accurate than the earlier edition. Only recently mapped, large-

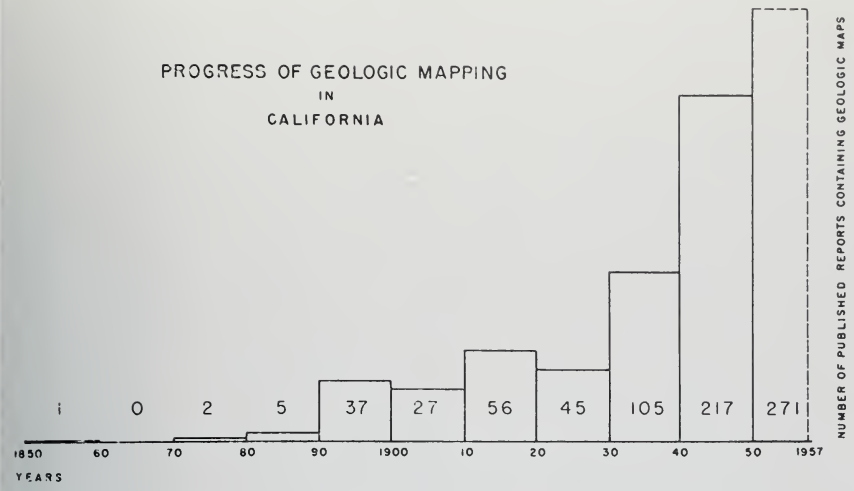


FIGURE 4.

scale topographic quadrangle maps were used in their preparation; in areas lacking recent quadrangle coverage, stereo-compilations from recent aerial photographs were made. Locations of all roads and cultural features also were revised, using recent aerial photographs, and an accurately plotted township land net will be included on the finished maps. Much better topographic expression has resulted from the reduction of the contour interval from 500 feet on the earlier edition to 200 feet (with 100-foot supplementary contours) on the new edition. This will enable the map user to locate the mapped geologic features much more readily in the field.

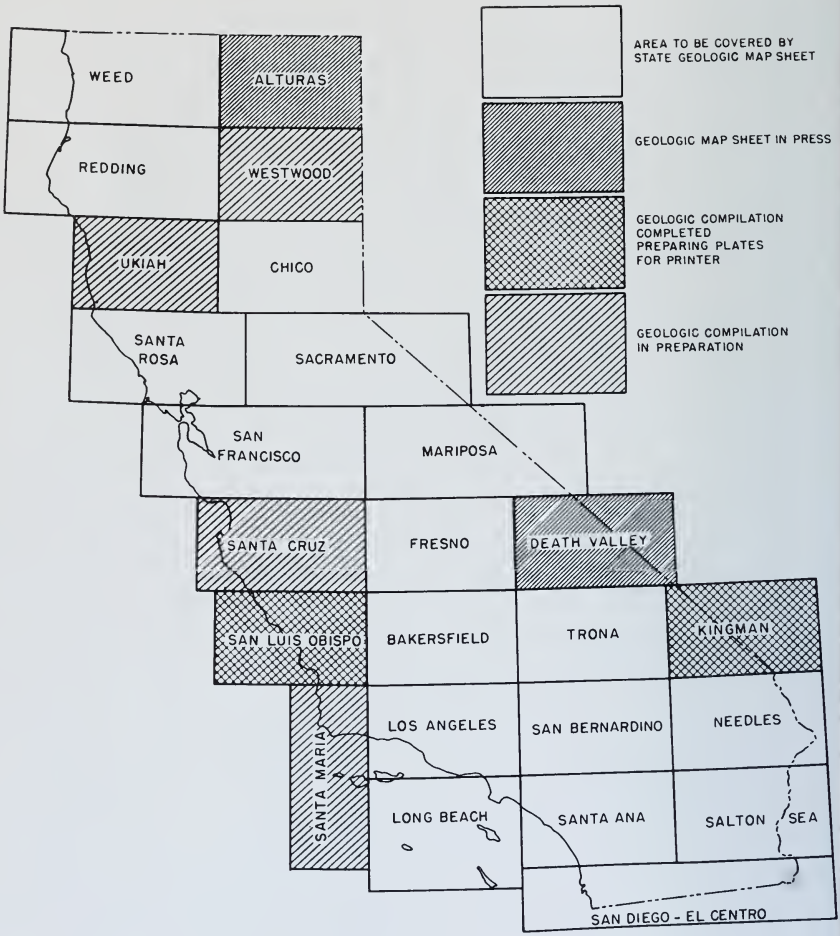
Eight advance sheets have been obtained (though all of these are not yet available to the public) and the geologic compilation thereon is either complete or under way (see index map). The new state geologic map will depict 105 geologic units by distinctive colors in patterns and the underlying topographic base will be printed in neutral color. Modern scribing techniques used by the Division's drafting department will provide quality and consistency of line work that is superior to pen and ink techniques. The result will be a more attractive and legible map at a lower cost.

Certain maps will be combined with adjacent ones to form single sheets for convenience in handling and for reducing the map area lying outside California's borders (see index map). A total of 25 geologic map sheets will thus be required, each of them designed to match the adjacent sheets in continuity in geology, in color, and in scale so

PHOTO 10 (opposite). Geologist in the field checks rocks at edge of a glacial lake. The area is in Matterhorn Peak quadrangle, recently mapped by a Division of Mines geologist. *Photo by C. W. Chesterman.*

PHOTO 11 (page 54). Work on the geology, mines, and mineral deposits of Kern County is now in progress. In Red Rock Canyon, shown in this photo, weathering has created an outstanding scenic area. *Photo by Mary Hill.*

PHOTO 12 (page 55). Northwest slope of Sugarloaf Mountain, a perlite dome with a steep-sided lava flow on its right flank. Southwestern Coso Range, near U.S. Highway 395. This dome is in the area covered by the Death Valley sheet of the new geologic map of California, in press during fiscal 1957-58. *Photo by C. W. Chesterman.*



PLAN AND PROGRESS OF GEOLOGIC MAP OF CALIFORNIA, SCALE 1:250,000

FIGURE 5.

that adjacent sheets can be trimmed and joined if desired. If the entire map were assembled, it would cover an area of about 14 feet by 14 feet.

The eight geologic map sheets which border the Pacific Ocean will show offshore topography by means of contours with a 300-foot interval. This information will be based on the bathymetric charts published by Professors F. P. Shepard and K. O. Emery which show submarine canyons, seamounts, troughs, valleys, and escarpments.

The geologic map sheets will be folded and distributed individually in envelopes together with an explanatory data sheet. The explanatory data sheet will contain: (1) a stratigraphic nomenclature chart, showing how the formational units have been grouped to form the state map units; (2) an index map and bibliography to the geologic mapping used to compile the geologic map sheet; and (22) an index map to the topographic quadrangles covering the area within the geologic map sheet.

Upon completion of all the individual map sheets, a geologic atlas is planned, to consist of all 25 geologic map sheets, their respective explanatory charts, and a full-page detailed geologic legend. The overall dimensions of the atlas will be 17 inches by 22 inches and each map sheet will be folded to the required size.

The Division of Mines does not conduct mapping projects on such a small scale as 1 : 250,000, although regional reconnaissance geologic mapping on a mile to the inch (1 : 62,500) scale is being carried on as time permits in areas where there are no geologic maps. This state map is considered to be a regional summary map wherein all detailed field mapping available, both published and unpublished, is integrated on a common scale. This map will also make apparent those areas where our geologic knowledge is lacking or the geology is imperfectly known, and will be useful in planning future detailed geologic work. Many of the geologic data for the state map have been generously contributed by several state and federal agencies, universities, and petroleum and mining exploration companies. These contributions are much appreciated and will probably be well worth the contributors' time and effort as they see their work coordinated with others to give a better understanding of the regional setting.

The state geologic map is in demand by a large number of public and private agencies, and by individuals interested in all types of engineering projects and land-utilization studies. Such a map gives basic information needed in exploration for metallic and nonmetallic mineral deposits and oil and gas. Highway engineers, water resources agencies, agricultural agencies, those conducting soil and vegetation surveys, soil conservationists, insurance underwriters, and the vacationing public all find the state geologic map useful in planning and carrying out their projects.

The geologic map sheets will be released individually as soon as they are completed and each sheet will be announced in *Mineral Information Service*. Sheets will probably be priced at $1.50 per copy, including the explanatory data sheet and a convenient 9- by 12-inch envelope.

Glossary. A *Glossary of geologic names of California*, which includes and brings up to date the data in previous glossaries, is in preparation. The glossary will contain all the published names given to geologic formations in California, a brief statement of the basic geology and economic significance of each formation, and the reference(s)

wherein each formation was first formally described. At present about 1,400 names (many with brief descriptions only) have been compiled, and are available to staff and public in card-file form at headquarters office in San Francisco. During November 1957, the U. S. Geological Survey published Bulletin 1056-A, *Geologic Names of North America introduced 1936-1955*, which contains many California names.

MINERALOGY AND PETROLOGY SECTION, AND EXHIBITS

Mineral Laboratory. During the 1957-58 fiscal year the public service laboratory of the Division of Mines received and reported upon 4,035 samples of rocks, minerals, and ores. This represents a decrease of 21 percent from the number of samples reported upon during the previous fiscal year, 1956-57. The decrease is a reflection of the final slackening of interest in prospecting for radioactive materials in California and normal resumption of the search for new deposits of metallic and nonmetallic industrial raw materials in the state.

During the past fiscal year, we received many letters of commendation for the outstanding services of the public service laboratory. Such interest in our activities and services stems primarily from continued interest in the development of California's mineral resources, the versatile program of the Division of Mines, and the satisfaction of the senders of samples.

The public service laboratory makes qualitative identifications and only two samples per month are accepted from the sender since the present facilities and personnel of the laboratory are not adequate to handle any more than this number. Many different types of materials are received for identification; a majority of them generally consist of various kinds of rocks (igneous, sedimentary, and metamorphic) and the silicate-type of nonmetallic minerals. Interest in the strategic ore minerals has not diminished, and the search for them in the state continues to contribute many samples to the public service laboratory.

The research facilities of the Mineralogy and Petrology Section were used extensively by the staff members of the Division of Mines. Most used equipment includes: the sieves and shaking machine for making screen analyses of silica sands, black sands, dune sands, and sands collected in conjunction with the economic mineral studies of the Cherokee pit; the high-temperature furnace to determine the expansion properties of shales and perlites, both materials useful as lightweight aggregates; the spectrographic equipment used in making qualitative and semi-quantitative spectrochemical analyses of materials under study by staff members; the differential thermal analysis apparatus, used for basic studies of clay minerals, limestone, expansible shales, and serpentine and associated garnierite; the petrographic microscopes and accessory equipment, used for making semi-quantitative mineral analyses of rocks in thin section and for identifying rocks and minerals; and the metallurgical microscope and polishing equipment for studies in the sulfides and other opaque ore minerals.

During the year, a Beckman spectrophotometer was acquired by the Mineralogy and Petrology Section. This valuable piece of equipment is to be used in making quantitave chemical determinations of

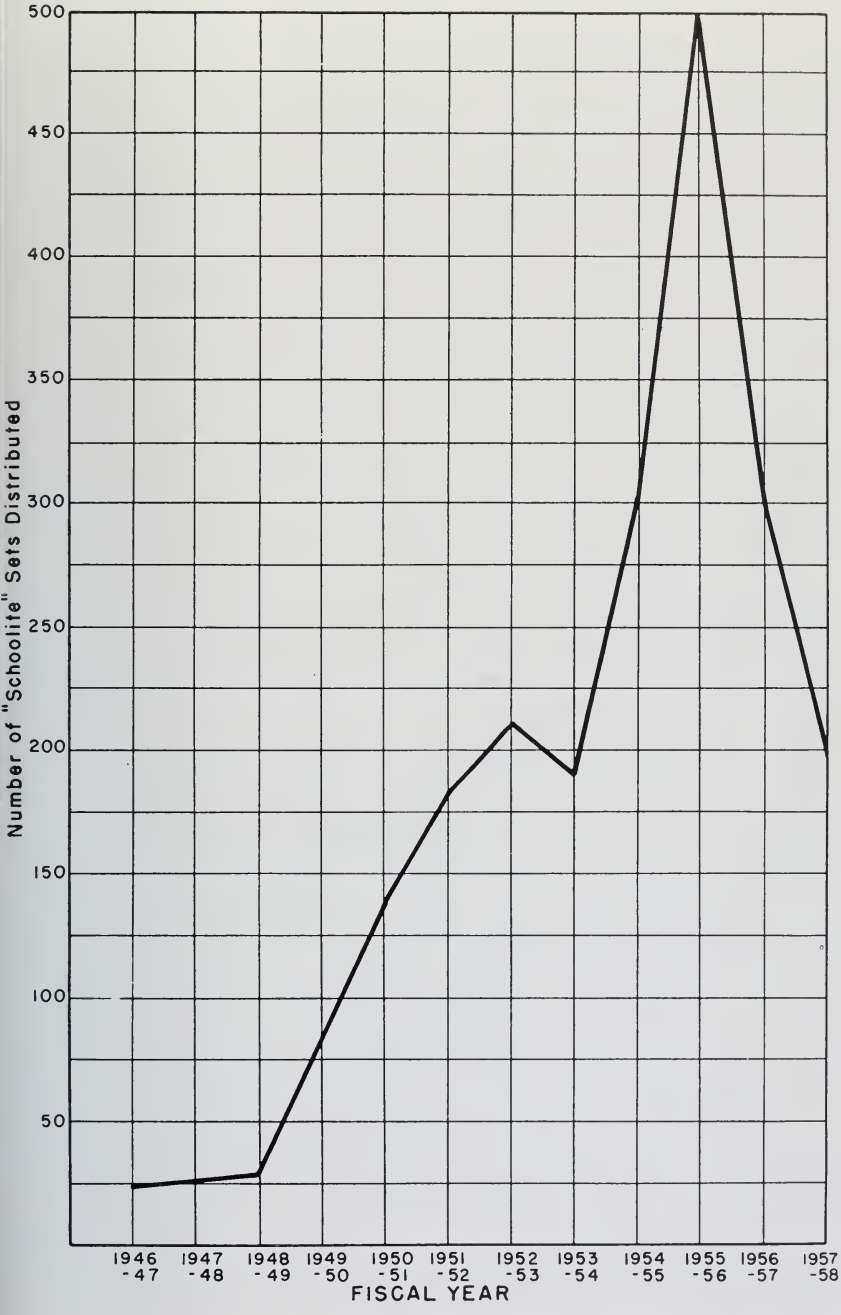

500
450
400
350
300
250
200
150
100
50
Number of "Schoolite" Sets Distributed
1946 -47
1947 -48
1948 -49
1949 -50
1950 -51
1951 -52
1952 -53
1953 -54
1954 -55
1955 -56
1956 -57
1957 -58
FISCAL YEAR

FIGURE 6.

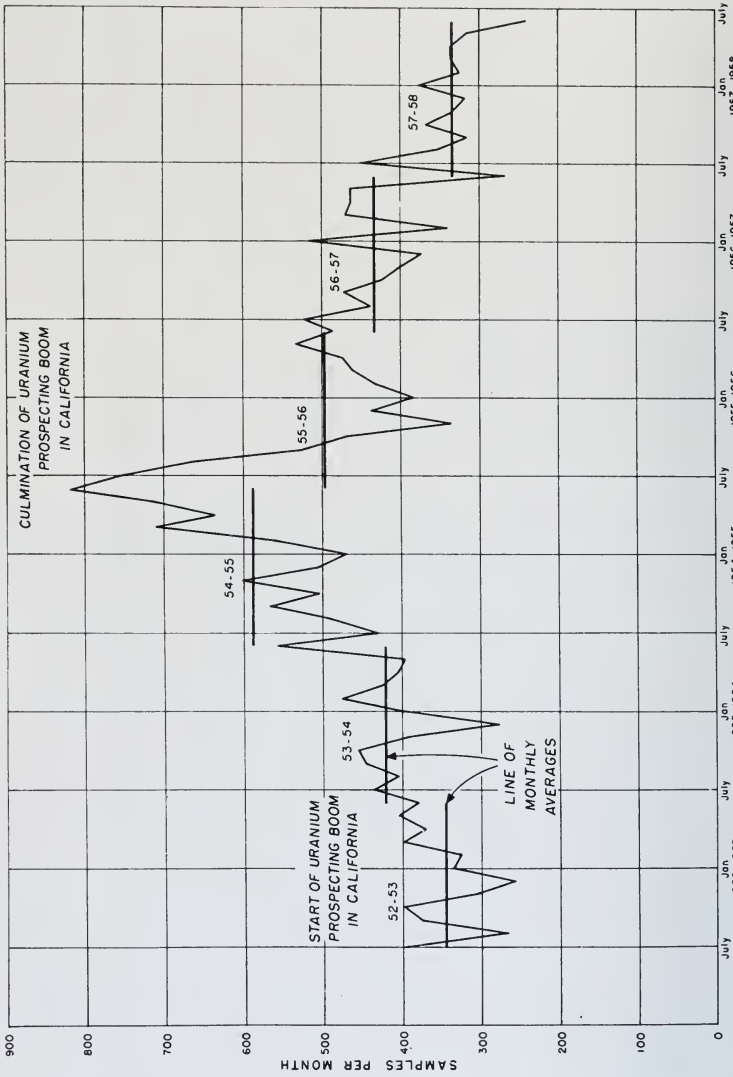

SAMPLES PER MONTH
900
800
700
600
500
400
300
200
100
0
July
Jan 1952-1953
July
Jan 1953-1954
July
Jan 1954-1955
July
Jan 1955-1956
July
Jan 1956-1957
July
Jan 1957-1958
July
FISCAL YEARS
CULMINATION OF URANIUM PROSPECTING BOOM IN CALIFORNIA
START OF URANIUM PROSPECTING BOOM IN CALIFORNIA
LINE OF MONTHLY AVERAGES
52-53
53-54
54-55
55-56
56-57
57-58

FIGURE 7.

many elements, especially the alkaline earth elements such as sodium, potassium, calcium, and magnesium.

Mineral Exhibits. The fiscal year, 1957-58 was again one of several accomplishments for the mineral exhibits. Reclassification of the mineral exhibits according to the Dana System had been completed during the previous fiscal year. Cataloging of the entire collection was started toward the close of the 1956-57 fiscal year and will be completed by December 1958.

A complete listing of all known mineral species was completed and submitted as an addition to the forthcoming reprinting or revision of *Minerals of California.*

The mineral exhibits continue to attract large groups of people. During the 1957-58 fiscal year this section of the Division of Mines played host to 27,110 visitors. Of this total, 24,123 or 88 percent were adults, and 2,987 or 12 percent were school children. Many of these visitors came from distant states and far-off lands, but a majority of them came from California and the elementary schools in the San Francisco Bay Area.

All of the exhibits were available at all times, from 9:00 to 4:00, Monday through Friday. The stamp mill and cement plant models were especially attractive because of their moving parts.

A total of 199 sets of California minerals and rocks (called "Schoolite sets" by the Division of Mines) was provided upon request, without charge, to the elementary schools throughout California. This number represents a decrease of 33 percent from the previous fiscal year, 1956-57, and indicates that our distribution of this educational material has reached a majority of the well-established schools, and is also keeping pace with the establishment of new elementary schools.

Mineral Accessions. During the fiscal year 1957-58 the Division of Mines accepted from the Department of Geology at the University of California a large number of chromium and manganese ore samples collected during World War I (1917-18) by the field geologists for the Committee on Geology and Mineral Resources (State of California) of which Professor G. D. Louderback (deceased) was chairman. This valuable assemblage of ore specimens is very comprehensive in scope and represents the many kinds of manganese and chromium ore minerals from the numerous mines and prospects in existence during the course of the investigation. Obviously, not all of this material can be exhibited and no attempt has been made to make a complete catalog.

The following specimens were donated to the Mineral Exhibits of the Division of Mines during the 1957-58 fiscal year:

21706 Hambergite ($Be_2(OH)BO_3$), basic borate of beryllium. From Little Tree mine, Ramona, San Diego County, California. Donor: John Sinkankas, September 1957.

21707 Betafite ($(U,Ca)(Cb,Ta,Ti)_2O_5 \cdot nH_2O$), Oxide or columbate-tantalate of uranium, calcium, and titanium. From Faraday Township, Hastings County, Ontario, Canada. Exchange: The Royal Ontario Museum, Toronto, Canada, November 1957.

21708 Diallage ($Ca,Mg(SiO_3)_2$), silicate of calcium and magnesium. From T. 40 N., R. 6 W., M.D., Trinity County, California. Donor: L. B. Wright, Southern Pacific Company, 1958.

21709 Wolframite ($(Fe,Mn)WO_4$), tungstate of iron and manganese. From 7 miles north of Mono Lake and 1 mile east of Highway 395, Mono County, California. Donor: O. B. Dean, 1958.

21710 Chrysotile ($H_4Mg_3Si_2O_9$), hydrous magnesium silicate. From Sierra Ancha, Gila County, Arizona. Donor: L. E. Town, 1958.

21711 Britholite, a complex silicate-phosphate-fluoride of the cerium metals and calcium. From Oka, Quebec, Canada. Exchange: V. B. Meen, The Royal Ontario Museum, 1958.

21712 Camsellite (szaibelyite) ($2MgO \cdot B_2O_3 \cdot H_2O$), hydrous magnesium borate. From near Stinson Beach, Marin County, California. Donor: Charles W. Chesterman, February, 1958.

MINERAL COMMODITIES

Since the late 1957 publication of the comprehensive treatise *Mineral Commodities of California,* Bulletin 176, commodity specialists have worked to keep abreast of new developments and new operations with the expectation of publishing supplemental information from time to time. Special emphasis is being placed on gathering of market information.

Statewide commodity studies have been vigorously continued. The results of one of these, *Salt in California,* by W. E. Ver Planck, was

PHOTO 13 (below). Vaqueros limestone conglomerate in Fremont Peak district. A report on the economic possibilities of the limestone and dolomite deposits of this area was completed and sent to press during the 1957-58 fiscal year. *Photo by Mary Hill.*

released in March 1958. Much information has been amassed toward publication of other comprehensive surveys of this sort, notably in the fields of limestone and dolomite, silica, clays, perlite and obsidian, sand, gravel and crushed stone, dimension stone, and peat. The Division of Mines has maintained close touch with the petroleum industry and with the Division of Oil and Gas; Mines' particular fields of interest being new discoveries, field extensions, and the geology of dry holes as related to surface geology.

Commodity studies of a more specialized or detailed nature, to be published as shorter contributions, are also an important part of the Division's commodity surveys. Numerous papers of this sort are in progress.

Limestone and Dolomite. Requests for information on California limestone and dolomite deposits continued at a high level, both from firms operating in California and from numerous out-of-state interests. Sampling and economic evaluation of deposits by the Division of Mines continued in 10 counties. Seventy-five samples were analyzed. Stratigraphic studies in carbonate rocks were concentrated in the Standard district of Tuolumne County, the Fremont Peak district astride the San Benito-Monterey County line, the Pico Blanco district of Monterey County, and the Briceburg-El Portal area of Mariposa County. More than 35 limestone and dolomite properties were examined during the year.

Papers on the economic possibilities of the limestone and dolomite deposits of the northern Gabilan Range and Standard district of Tuolumne County were readied for press and a large volume of data for the county report series was in press or nearing completion for San Diego, Calaveras, Contra Costa, Kern, Shasta, and Tulare Counties. The list of producers of limestone, dolomite, and lime products was revised for both northern and southern California.

Portland Cement. Following closely the slight cutback of 1956, production of portland cement again fell off slightly during the past fiscal year. The recession was most noticeable in southern California where production was down about 6 percent. This recession appears to be only temporary and raw materials exploration is continuing unabated among nearly all of the operating companies. The San Diego and Central Valley marketing areas continue to be of special interest.

Clay. Preparation of a geologic map of the clay-bearing belt of the Little Antelope Valley area, Mono County, was completed by George B. Cleveland. A geologic map and description of the bentonite-bearing beds near Otay, San Diego County, was also prepared by Mr. Cleveland. Detailed investigation of the Filtrol bentonite deposit of Kern County was initiated. Nine clay deposits in San Diego County were visited and described and five clay deposits were examined in other parts of southern California.

In northern California laboratory studies on the ceramic properties of Eocene clays near Cherokee in Butte County were conducted as part of the economic evaluation of gold, silica, and clay deposits in the Cherokee hydraulic mine vicinity. Four operating deposits in central California were visited and more than 10 undeveloped deposits in Butte and Nevada Counties were examined. Detailed stratigraphic studies of the clay-bearing Eocene formations in Butte County were completed, as well as numerous supporting laboratory sedimentation

PHOTO 14 (opposite). Cherokee hydraulic pit, Butte County. During fiscal 1957-58, laboratory studies of the ceramic properties of Eocene clays in the vicinity of Cherokee were conducted as part of the economic evaluation of gold, silica, and clay deposits in the mine. *Photo by Mary Hill.*

studies. Firing tests on potentially valuable brick-clays were conducted as well as differential thermal analysis tests on a wide variety of clays of potential economic importance. The bibliography on clays was revised for the Information Service.

Silica. Work, primarily of a reconnaissance nature, continued on the statewide survey of commercial and potentially commercial silica resources of California. A preliminary study of the vein-quartz and quartz-feldspar pegmatite deposits was completed by W. E. Ver Planck. Several typical deposits have been selected for future detailed mapping. Quartzite for the California manufacture of silica brick has come mostly from the Ordovician Eureka quartzite near Owens Lake, Inyo County, and from the Carboniferous Oro Grande series near Victorville, San Bernardino County. Several other quartzite formations, for which mineralogical and chemical data are lacking, were examined. Samples of the Lower Cambrian Zabriskie quartzite near Shoshone, Inyo County, were taken for laboratory evaluation.

Reconnaissance exploration was continued for deposits of gravel having a high proportion of quartz cobbles large enough to supply current demand for this type of material. Tertiary channel deposits in Nevada County were found to be relatively low in quartz cobbles greater than 2 inches in diameter. Substantial deposits of quartz cobbles were observed in Sheephollow Creek and Greenhorn Creek, but the size of the cobbles is somewhat smaller than those that have been recovered from the middle reaches of the Bear River.

Preliminary studies of the numerous white silica sand deposits have been initiated. Heavy liquid separations were completed on a suite of desert sand samples from central and eastern San Bernardino County and several other samples were examined in the laboratory. One, from the upper Miocene Santa Margarita formation near Bakersfield, Kern County, is a feldspathic sand; another, from the Eocene Yokut sandstone near New Idria, San Benito County, is a sand having a high proportion of quartz and black chert; a third set of samples from the Santa Margarita formation southwest of Salinas was high in biotite and in feldspathic rock fragments.

Borates. Interest in borates, the chief source of boron for the recently developed high-energy fuels, continues to be great. A summary of the borate resources of the state was prepared and published in Mineral Information Service and visits were made to most of the colemanite deposits. Since discovery of the vast sodium borate deposits at Boron, Kern County, the colemanite deposits have been worked to a limited extent only. If a greater demand for boron develops, they may be reopened on a far larger scale.

Petroleum Fuels. Petroleum, natural gas, and natural-gas liquid derivatives account for 75 percent of the current value of California's mineral production. In spite of their high position in the gross mineral

PHOTO 15 (opposite). Gas-scrubbing plant of the Southern California Gas Company, Trico gas field, Tulare County. Summaries of oil and gas exploration were prepared as part of the mining inventory reports for Contra Costa and Tulare Counties during fiscal 1957-58. *Photo by Mary Hill.*

production of the state, production and reserves of petroleum products are declining. As most of the prolific shallow fields are believed to be already discovered, the petroleum industry has directed its recent exploratory effort primarily toward deeper drilling, drilling in residential areas, exploring for extensions of known fields, secondary petroleum recovery practices, and tideland drilling.

In addition to publication of the recent comprehensive report, Bulletin 176, covering all of California's mineral commodities, the public has been kept informed on trends in exploration, production statistics, and tideland leasing laws through articles in *Mineral Information Service*. Summaries of oil and gas exploration were prepared as part of the mineral inventory reports for Contra Costa and Tulare Counties, and several others are in process of preparation. In the exhibit hall a collection of 45 marine fossil shells, many of which are found in strata of California oil fields, was labeled and placed on display.

Sand and Gravel. The Division's continuing program of inventory of the state's resources of usable sand and gravel is progressing steadily. A comprehensive report on the *Sand and gravel resources of Cache Creek in Lake, Colusa, and Yolo Counties*, by Ira E. Klein and Harold B. Goldman was released this year. A similar report on the aggregate resources of the Kern River near Bakersfield is rapidly nearing completion. These studies are confined to individual river drainage areas and present data on the geologic occurrence, quantity and quality of the deposits, processing, and utilization by industry. Many of the data are obtained from cooperating state and federal agencies such as the U.S. Bureau of Reclamation, State Division of Highways, and U.S. Corps of Engineers.

A paper on *Franciscan chert in California concrete aggregates*, by Harold B. Goldman, was completed and transmitted for publication. This report covers the chemical suitability of sand and gravel containing Franciscan chert for use in portland cement concrete. The results of this investigation will assist sand and gravel producers by demonstrating that commercially proven aggregates containing Franciscan chert are not to be considered inferior because of suspected chemical reactivity.

A similar investigation on reactive rock types in California aggregates for potential use in concrete is underway to designate the sand and gravel deposits that do contain chemically reactive ingredients and to compile data on the actual amount of harmful material present in the deposit.

Dimension Stone. The statewide survey of the dimension stone industry was continued to obtain information on the types and suitability of rock used, nature and extent of commercial deposits, and economics of developing and marketing a new stone. The Division has received increasing numbers of inquiries concerning this commodity; information,

obtained through field investigation and correspondence, is dispensed by letter, personal interviews and via *Mineral Information Service.*

Crushed Stone. The suitability of the geologic formations in the San Francisco Bay Area for use as crushed rock was studied in detail as part of the Contra Costa County inventory. This information is in process of publication.

Talc. Geologic maps of the Excelsior mine area, eastern Kingston Range, San Bernardino County, and the Montgomery mine area, southern Panamint Range, Inyo County, were prepared. Geologic mapping of the talc-bearing belt in the western Kingston Range was initiated. Data were gathered on 15 talc mines in Inyo and San Bernardino Counties and manuscript work on the talc deposits of the southern Death Valley-Kingston Range region was continued. The talc and soapstone section for the third edition of *Industrial Minerals and Rocks,* American Institute of Mining and Metallurgical Engineers, was coauthored by Division commodity specialist Lauren A. Wright of the Los Angeles office.

Diatomite. A description of the Poverty Hills diatomite deposit, Inyo County, by George B. Cleveland, was completed and submitted for publication. Field and laboratory investigations of the Long Valley deposit, Mono County, were started. A statewide diatomite resources reconnaissance, involving 16 property visitations, was completed, and numerous samples were collected for laboratory evaluation. An index of California deposits was completed.

Gold. A statewide tabulation of gold deposits was largely completed by W. B. Clark at the Sacramento office. Particular attention was paid to gold deposits in the Randsburg, Mojave, Kern River, and Rademacher districts of Kern County by the Los Angeles office.

Barite. Field investigation of the Labrea barite deposit of Santa Barbara County was initiated.

Lead-Zinc-Silver. Field investigation of the Queen of Sheba mine, Inyo County, was started and deposits of lead-zinc-silver in the Silurian Hills, San Bernardino County, were examined. A comprehensive Special Report on the Darwin district, a cooperative U. S. Geological Survey project, was in press at the close of the fiscal year.

Perlite. A statewide report on perlite is in preparation, which includes sections on geology, processing, utilization, marketing, and property descriptions.

Obsidian. A comprehensive report on California obsidian is under way as a cooperative project between the Division of Mines and the California Academy of Sciences. The report will cover the geology and uses of obsidian and will contain descriptions of potentially economic deposits.

PHOTO 16 (opposite). Outcrop of Franciscan chert in Marin County. During fiscal 1957-58 a paper on Franciscan chert in California concrete aggregate was completed, covering the chemical suitability of sand and gravel containing Franciscan chert for use in portland cement concrete. *Photo by Mary Hill.*

Jade. Investigations of jade occurrences in California were continued. Extension of the Leach Lake Mountain map area proved advisable, not only because of jade occurrences there, but because of unique exposures of serpentinized peridotite sills. This study should add much to our knowledge of the mode of emplacement of serpentine intrusions.

Nickel. Statewide investigation of nickel resources was pressed. One hundred and twenty samples were gathered and submitted for nickel assay, the sampling including the parent serpentine as well as the potential ore. Reconnaissance was concentrated in Del Norte, Siskiyou, Humboldt, and Mendocino Counties. Interest in the Division's program was manifested by the large numbers of requests for information processed. Exploration projects, stimulated at least in part by information acquired by the Division, were initiated by two companies at Gasquet Mountain, Del Norte County, and Red Mountain, Mendocino County. Although most California serpentines contain some nickel, the most promising environments for nickel concentration appear to lie in remnants of early Tertiary erosion surfaces where deep weathering has resulted in enrichment of nickel in the soil and subsoil. In addition to the nickeliferous laterite studies, the nickel survey will ultimately cover the nickeliferous sulfide occurrences of California. A summary of the results of this survey was published in the nickel chapter of Bulletin 176.

Black Sands and Heavy Mineral Concentrates. There has long been a need for information concerning the mineral content of California black sands, both stream and beach, and for the heavy mineral concentrates produced by many sand and gravel operators, gold dredges, and silica-sand processors. The Division of Mines has initiated work toward a statewide survey of mineral concentrations of this sort.

LOS ANGELES OFFICE

During the fiscal year 1957-58 the members of the Los Angeles staff were engaged in a wide variety of activities, most of which can be grouped in the following categories: (1) county reports, (2) mineral commodity investigations, (3) basic geologic mapping, and (4) public information services. In the course of 320 man-days of field work about 390 examinations of mineral deposits were made, 2,000 square miles were mapped in geologic reconnaissance, and the geology of about 50 square miles was mapped in detail. Wherever possible, the county, commodity, and field mapping assignments were facilitated by means of multiple-purpose field trips whereby, for example, commodity studies and reconnaissance mapping were pursued largely in the counties whose general resources were being investigated. Eight reports, intended for publication, were either completed or submitted in preliminary manu-

PHOTO 17 (opposite). Sawing black granite at Escondido quarry, San Diego County. The statewide survey of the dimension stone industry was continued during fiscal 1957-58. *Photo by Mary Hill.*

PHOTO 18 (page 72). Dump of Sheep Ranch gold mine, Calaveras County. During fiscal 1957-58 a statewide tabulation of gold deposits was largely completed at the Sacramento office of the Division. *Photo by Mary Hill.*

PHOTO 19 (page 73). Union gold mine, Calaveras County. *Photo by Mary Hill.*

PHOTO 20 (opposite). Pardee Dam in Calaveras County. Mines and mineral resources of the county were inventoried by the Sacramento office of the Division, and a report completed for publication during 1957-58. *Photo by Mary Hill.*

script form. Seven other manuscripts were in the end stages of preparation at the end of the year.

During the year especial emphasis continued to be placed on the county resources report program as the principal means of compiling a systematic mineral inventory of southern California. Lengthy reports on Kern and San Diego Counties, which have been in process for several years, were brought to near completion. A Riverside County report was assigned and was about 25 percent complete by the end of the year. Work on an Orange County report was continued on a limited basis. Data on numerous mineral deposits in other counties of southern California were gathered for incorporation in future county reports. A previous section on *Inventories of mining activities and county resources reports* includes further mention of progress in this area from the Los Angeles office.

Mineral commodity investigations by the Los Angeles office are summarized in the statewide report in the section on *Mineral commodities.* Progress was made in the investigation of barite, clay, diatomite, gold, lead-silver-zinc, limestone, manganese, mica, talc, and tungsten.

Los Angeles staff geologists were active in geologic mapping, including reconnaissance of about 2,000 square miles of previously unmapped portions of the Death Valley, Kingman, Needles, San Diego, and Trona sheets of the state geologic map. A number of detailed basic geologic maps on the scale of 1:24,000, and larger, were completed. (See sections on *Basic geologic mapping* and *State geologic map.*)

Some figures on public services performed by the Los Angeles office will serve to emphasize the large public demand for information on geology and the mineral industries in that area. During the fiscal year 1957-58 Los Angeles staff members conferred with 8,319 visitors, answered 11,145 telephone calls, sent 2,304 pieces of mail, and sold 4,878 items valued at $6,480. These figures were lower than those of the preceding year—a decrease largely attributable to the waning interest in uranium prospecting and to the out-of-print status of several of the most sought publications.

The most popular of the available publications were the Legal Guide (683 copies), State geologic map sheets (679 copies), parts of Bulletin 170 (301), San Bernardino County map (218 copies), Bulletin 176

(216 copies in 6 months), Bulletin 173 (188 copies), Los Angeles County map (150 copies), Bulletin 141 (140 copies), and the San Bernardino County report (112 copies).

The rock and mineral exhibits, and the map and publication displays in the Los Angeles office were completely revamped during the year. These changes considerably lessened the amount of oral explanation necessary at the information desk and made the average visitor more aware of the functions of the Division of Mines. The library facilities of the Los Angeles office were rearranged and expanded.

Numerous professional and semi-professional groups were addressed or guided on field trips. These activities and professional contacts were similar to those shown in the examples in the previous section on *Public appearances.*

SACRAMENTO OFFICE

The principal area of activity of the Sacramento branch office is the Sierra Nevada and the Great Valley in central and northern California. The technical staff, which consists of two mining geologists, devotes much of its time to the preparation of reports on the mineral resources of the counties in the region. A continuous survey is made of the mining activities in the area, which is coordinated with county reports and mineral commodity studies. The geographic location of this office makes it convenient for concerns and persons interested in the mineral resources of this region to visit and obtain information and publications. As the population and industrial capacity of central and northern California have increased greatly, the demand for mineral raw materials, especially industrial minerals and fuels, has increased proportionately.

During the past fiscal year there was an increase in demand for the public information services of this office. An extensive report on the mines and mineral resources of Calaveras County was completed during the year. Information was obtained on more than 800 mineral properties. Also a report on the geology and petrography of the Poe Tunnel, Butte County was completed. Articles on gold, platinum, quartz and quartzite, sulfur and sulfuric acid, and titanium were published in Bulletin 176. An article on sulfur and pyrite was published in the May 1958 *Mineral Information Service.* Geologic mapping of the Greenwood, Kaiser Peak, and Mt. Abbot quadrangles is in progress. A statewide survey of the gold mining districts was well under way. All major projects are carefully coordinated with the main office in San Francisco and the other branch offices. Progress of the Sacramento office on *Inventories of mining activities and county resources reports, Mineral commodities* investigations, and *Basic geologic mapping* has been summarized in the previous sections under these headings.

Photo 21 (opposite). Burney Falls, Shasta County. During fiscal 1957-58 staff members of the Division's Redding office assisted the State Division of Beaches and Parks to depict the geology of the falls for a display case at Burney Falls State Park. *Photo by Mary Hill.*

The small Sacramento staff has developed a fine public relations and information program. Staff members presented illustrated talks to a number of mineral and gem societies and Boy Scout troops. The staff also participated in two mineral shows and helped to prepare the State Fair exhibit. Meetings of national and local professional societies were attended and an active part was taken.

REDDING OFFICE

The Redding branch office is located in an area having a great variety of mineral deposits which have contributed several hundred millions of dollars to our economy. Engineers and geologists in government service and consultants in private practice made much use of the publications, maps, and technical information available at this office during the year. There was an increased interest in prospecting and small-scale placer mining, and the number of rocks and minerals brought in for identification increased substantially.

The technical staff of the Redding office consists of the district mining engineer and an associate mining geologist, who was transferred to this district from Los Angeles in July 1957. During the past fiscal year, the geology of the Alturas sheet was mapped and accepted for inclusion in the new State geologic map. A mining geologist from the San Francisco headquarters assisted in this project. The Shasta County report was revised and progress was made on the Modoc and Trinity County reports.

The mining geologist was a guest speaker on the television course on geology offered by Shasta College. Talks were also given to elementary school classes, and students were assisted in assembling and classifying their mineral specimens. The Shasta County Agricultural Commissioner was assisted in assembling and labeling the Shasta County mineral exhibit for the State Fair, which was awarded first place in the sweepstakes for metallic minerals and second place for nonmetallic minerals, as well as many first and second place awards for individual mineral specimens. The geology of Burney Falls—its origin and evolution—was depicted for a display case at Burney Falls State Park in collaboration with the State Division of Beaches and Parks. A geologic report on the Big Bend area presented for publication was critically reviewed. Much of the time of the technical staff is devoted to people asking for information on mines, mineral deposits, geology of areas, mining, uses and markets for minerals, methods of treatment for ores and minerals, and mining law. Mining operations in Shasta, Siskiyou, Tehama, and Trinity Counties were checked during the year.

PHOTO 22 (page 78). Mount Lassen and Manzanita Lake, Shasta County. During fiscal 1957-58 a report on the mines and mineral resources of Shasta County was put into final form by the Division's Redding office, in preparation for publication. *Photo by Mary Hill.*

PHOTO 23 (page 79). Bumpass Hell, spectacular hot spring area in Lassen Volcanic National Park, provides a cover photo for the new list of available publications of the California Division of Mines, prepared during fiscal 1957-58. *Photo by Mary Hill.*

REPORT OF THE U. S. GEOLOGICAL SURVEY ON COOPERATIVE STUDIES OF MINERAL DEPOSITS IN CALIFORNIA (FISCAL YEAR 1958)*

By Preston E. Hotz
U. S. Geological Survey, Menlo Park, California

The U. S. Geological Survey continued its studies of mineral deposits in California during the fiscal year beginning July 1, 1957 under a cooperative agreement with the California Division of Mines. The cost of these projects at the field level was about $70,000 and, as in previous years, half the cost was shared by the state. No new projects were added this year, but one was reactivated in January 1958; and at the end of the year six projects were being maintained under the cooperative program. These are the South Klamath Mountains, Sierra Foothills Mineral Belt, Eastern Sierra tungsten, Bishop tungsten, Mt. Pinchot quadrangle, and Panamint Butte quadrangle projects. The Bishop tungsten project was reactivated in January 1958 when the project chief completed the administrative duties that had occupied him for the past two years. With completion of the final report the Bishop project terminated on June 30, 1958. The Mt. Diablo project, which was started in January 1957, was completed in November 1957.

South Klamath Mountains Project. The South Klamath Mountains project is a geologic study of two and one-half 15-minute quadrangles in the southern part of the Klamath Mountains province. The quadrangles, listed from east to west, are the west half of the French Gulch quadrangle in Shasta County, and the Weaverville and Hayfork quadrangles in Trinity County. The east half of the French Gulch quadrangle has been studied previously as a part of the West Shasta project.

The three quadrangles form a strip that lies across the north-northwest trending structural and lithic grain of the Klamath Mountains province. The French Gulch quadrangle is underlain chiefly by Copley greenstone of Devonian (?) age and Balaklala rhyolite of Devonian age, and by the Bragdon formation of Mississippian age. Along its western side it includes about half the Shasta Bally batholith. The Weaverville quadrangle is underlain chiefly by the Abrams mica schist and Salmon hornblende schist of presumed pre-Silurian, possibly Precambrian, age. In its eastern part it includes the other half of the Shasta Bally batholith, a large area of ultramafic rocks and relatively small areas of Copley greenstone and Bragdon formation. Part of a belt of little known rocks of Paleozoic and Triassic ages underlies the southwestern part of the Weaverville quadrangle. These rocks are chiefly slates, cherts, and greenstones, and are the principal rocks found in the Hayfork quadrangle.

Geologic mapping of the west half of the French Gulch quadrangle was begun during the summer of 1956, and was completed by late summer in 1957. The map of the west half of the quadrangle was compiled with a revised and generalized version of the published, larger scale map of the east half of the quadrangle, for publication as a 15-minute quadrangle geologic map. A report describing the geology and mineral resources of the French Gulch quadrangle was begun in the

* Publication authorized by the Director, U. S. Geological Survey.

fall of 1957 and is nearly completed. Work was started in Weaverville quadrangle in September 1957.

In addition to work on the French Gulch quadrangle and a little in the Weaverville quadrangle during fiscal year 1958, a report that describes the results of the Trinity River project was completed. Part of the Trinity River project was in cooperation with the California Division of Mines, and the report on the reconnaissance of the northern Coast Ranges and Klamath Mountains, California, is tentatively planned for publication by the California Division of Mines as a Special Report.

Sierra Foothills Mineral Belt. The region included in the study of the Sierra Foothills Mineral Belt is in the lower part of the western slope of the Sierra Nevada from about the latitude of Yosemite National Park on the south to the North Fork of the Feather River on the north. Its eastern boundary is the Sierra Nevada batholith, and its western limit is the line of overlap of bedrock by unconsolidated deposits of the Central Valley. The region includes the famed Mother Lode, Grass Valley-Nevada City, and Alleghany gold districts and the Foothill copper belt. In addition to the gold and copper, less important amounts of tungsten, chromite, barite, and amphibole asbestos also have been mined. In recent years increasing production of cement and other limestone products has demonstrated the importance of limestone deposits of the western Sierra Nevada to the industrial and agricultural needs of the state.

The Foothills mineral belt is underlain mostly by metamorphosed Paleozoic and Mesozoic sedimentary and volcanic rocks, which are intruded by serpentine and granitic rocks of Mesozoic age. The metamorphic rocks are strongly folded and faulted and fossils are scarce. The general distribution of the rocks is known from geologic maps published between 1895 and 1900. The present investigation is aimed at obtaining information that will supplement the older data and aid in interpreting the regional structure and stratigraphy. Field work consists of detailed geologic mapping along the canyons of the major streams that cross the region about at right angles to the geologic structure. The data from these surveys are projected between canyons by using the earlier maps.

The past fiscal year was spent in laboratory work and the preparation of reports. Two manuscripts tentatively entitled, "Structure and stratigraphy of part of the western Sierra Nevada, California" and "The Foothills Fault system, western Sierra Nevada, California," were completed and submitted for review. A summary of the second paper was presented orally at the meeting of the Cordilleran Section of the Geological Society of America.

Eastern Sierra Tungsten. The area being investigated under the Eastern Sierra tungsten project includes five 15-minute quadrangles north and west of the Bishop tungsten district. The Casa Diablo Mountain and Mt. Morrison quadrangles were mapped previously, and mapping is in progress on the Devils Postpile quadrangle. Reports are prepared for each quadrangle as the mapping is completed. Two reports on the Casa Diablo Mountain quadrangle have been published; during the fiscal year a report on the Mt. Morrison quadrangle was extensively revised following critical review, and submitted for further

processing. At the end of the 1957 field season about half of the Devils Postpile quadrangle had been mapped.

The quadrangle includes an extensive roof pendant that consists chiefly of metamorphosed volcanic tuffs, flows and breccias, related intrusives, and minor amounts of metamorphosed sedimentary rocks. Mapping in the eastern part of the pendant shows that the structure is homoclinal and that tops of beds are to the west through a thickness of at least 25,000 feet. If the homoclinal structure continues into the eastern part of the pendant the total thickness exceeds 40,000 feet. These Mesozoic metavolcanic rocks overlie unconformably a sequence, more than 30,000 feet thick, of Paleozoic metasedimentary rocks in the Mt. Morrison pendant.

Ordovician, Silurian(?), Pennsylvanian, and Permian(?) fossils were found in the Mt. Morrison pendant, and fossils of Early Jurassic age were found in the pendant in the Devils Postpile quadrangle. The fossils found in these pendants are the only ones that have been reported from a belt of roof pendants that stretches for 200 miles along the crest of the high Sierra Nevada. Because of the stratigraphic, structural, and historical significance attached to these fossils, a short paper was prepared during the winter office season announcing their discovery and describing their relationship to the stratigraphic sequence.

Bishop Tungsten Project. The Bishop tungsten project was recessed January 1, 1956, for 2 years when the project geologist was assigned to administrative duties, and it was reactivated January 1, 1958. On completion of the second of two manuscript reports the project was terminated June 30, 1958. The project included geologic mapping and study of the mineral deposits in the Mt. Tom, Bishop, and Big Pine 15-minute quadrangles, and part of the Mt. Goddard 15-minute quadrangle, in east-central California, near Bishop. Since 1916, when tungsten was first mined in the Tungsten Hills, to the end of 1953, approximately 1,300,000 units of WO_3 (tungsten trioxide) were produced from mines in the Bishop district. In addition the district yielded significant amounts of copper, molybdenum, gold, pumice, perlite, talc, barite, and sand and gravel.

A report entitled "Economic geology of the Bishop district, California" was published in 1956 by the California Division of Mines. This report includes detailed descriptions of the contact metasomatic tungsten deposits with discussions of features that bear on their exploration and development.

In 1956, when the project was recessed, a second report tentatively entitled, "Geology and tungsten mineralization of the Bishop district, California," was partly prepared, and between January 1 and June 30, 1958 it was completed. This report consists of three parts. The first part deals with the pre-batholithic geology. It includes stratigraphic descriptions of Early Cambrian and late Precambrian formations in the White Mountains, and of middle and late Paleozoic and Mesozoic strata in pendants, septa, and inclusions in the Sierra Nevada. Complex structures that were formed in these rocks during an orogenic episode culminating in the intrusion of the Sierra Nevada batholith in late Mesozoic time are described. The second part deals with the Sierra Nevada batholith. It includes descriptions of the intrusive rocks, of the primary structures within these rocks, and of structures imposed on the

older rocks as a result of their emplacement. The mode of emplacement of the batholith is considered. This part of the report also includes a discussion of contact metasomatic tungsten mineralization based on information gathered in the study of the district. Descriptions of individual mines and prospects published in the first report are not repeated. The last part of the report deals with the Cenozoic geology. The alluvial and volcanic deposits of Cenozoic age are described, and a concluding section deals with the evolution of the landscape through structural and geomorphic processes.

Mt. Pinchot Quadrangle. The Mt. Pinchot quadrangle is immediately south of the Bishop tungsten district and includes part of the crest and east slope of the southern Sierra Nevada. The quadrangle contains only a few small deposits of tungsten and gold, but excellent exposures of bedrock in high glaciated parts make it especially suitable for detailed study of the granitic rocks. Geologic mapping of the quadrangle was completed during the 1957 field season, and a comprehensive report was prepared during the winter. This report has been submitted for critical review.

Within the quadrangle the Sierra Nevada consists chiefly of a complex of small intrusive masses that range in composition from quartz diorite to alaskite. Many of these masses are compositionally zoned from a more mafic margin to a more felsic interior. Variations in mineral content, specific gravity, composition of plagioclase, and nature of the potassium feldspar were studied in several masses. Septa and small pendants are present within the mosaic of plutonic masses. The largest of these contains about 7,000 feet of Mesozoic metavolcanic rocks—mainly metarhyolite tuff. These rocks are in a steeply dipping homoclinal sequence in which the tops face to the southwest.

Mount Diablo Project. The Mount Diablo project was completed in the first half of the fiscal year. A geologic map of approximately 25 square miles in the Mount Diablo quicksilver district was prepared and the mineral deposits were studied, with special emphasis on the quicksilver deposits. A report describing the geology and mineral deposits of Mount Diablo has been prepared for publication and is presently being processed for publication.

Mount Diablo, a prominent landmark in the central Coast Ranges, is made up of rocks of the Franciscan formation, diabase, and serpentine, which are in a roughly circular block bounded by faults. This block of rocks is up-faulted into the central part of a north-trending anticline made up of a thick section of Upper Jurassic to Recent strata. Quicksilver deposits are found in silica-carbonate rock and in rocks of the Franciscan formation; asbestos in serpentine; and copper, gold, and silver in diabase. The diabase has also been a source of crushed rock.

Panamint Butte Project. The Panamint Butte project is part of a long range program to study the Inyo County lead-silver-zinc deposits. The project entails mapping the Panamint Butte quadrangle and 10 square miles in the northwest part of the Maturango Peak quadrangle to include all of the Modoc lead-silver district.

A geologic map of the Panamint Butte quadrangle was completed, and large scale maps of the Modoc, Minnietta, and LeMoigne mines were prepared. The regional mapping has resulted in the unravelling

of the complex structure of the metamorphosed Paleozoic rocks in the Modoc district in the Argus Range. Mapping in the Panamint Range has shed additional light on the origin of the chaotic disorder of rocks in the Death Valley area. The chaos in the Panamint Range is associated with large Mesozoic thrust faults.

Two reports are being prepared. One describes the economic geology of the Modoc district and the other the stratigraphy and structure of the quadrangle.

COOPERATIVE STUDIES WITH OTHER AGENCIES

For many years, the U. S. Bureau of Mines has cooperated with the State Division of Mines by gathering statistics on annual mineral production from mine operators. These figures the Division tabulates, rearranges, and interprets. The Bureau recently completed a report on the characteristics and properties of the upper Eocene San Benito County bentonite, for which the Division of Mines contributed geologic mapping data. At the close of the fiscal year, the State of California and U. S. Department of the Interior signed a more formal agreement to broaden the basis for cooperative work between the U. S. Bureau of Mines and the Division of Mines. It is expected that the Division, under this program, will publish certain Bureau studies which apply particularly to California. Currently, an inventory report on mercury in California, compiled by a Bureau mining engineer, is being edited for publication by the Division. Informal cooperation with the Bureau, under its regional administrator R. B. Maurer, has been very successful for the past several years.

Only minor progress was made in 1957-58 on the preparation of layman's guides to the geologic features of State Park areas in cooperation with the State Division of Beaches and Parks, as joint efforts of the two Divisions and the Department of Natural Resources to obtain budgetary support for this type of work were unsuccessful. A mining geologist at Redding made field examinations and assisted in the preparation of exhibits of geological materials for McArthur-Burney Falls Memorial State Park. Incidental to its regularly scheduled field work, Mines continues to accumulate information on the geology and mineral resources of State Park areas.

The State Department of Water Resources and Division of Mines have found it mutually profitable to exchange information on geologic mapping. The Division has furnished reconnaissance geologic maps to Water Resources on frequent occasions. Water Resources supplies Mines with all necessary copies of the U. S. Geological Survey topographic maps which are prepared with state and federal cooperative funds.

Other state agencies, such as the Division of Highways, Division of Forestry, Division of Oil and Gas, and Conservation Education in the Department of Natural Resources, frequently utilize information furnished by the Division of Mines.

The U. S. Coast and Geodetic Survey, U. S. Bureau of Land Management, and U. S. Forest Service are among the federal agencies with which the Division of Mines is most concerned. Currently, the Coast and Geodetic Survey is cooperating with other agencies and Mines on an integrated scientific report of investigations of the San Francisco earthquake of March 1957, to be published by the Division of Mines.

A number of Division of Mines projects, in 1957-58, involved active cooperation with universities in California, particularly the University of California (Berkeley and Los Angeles) through its Division of Mineral Technology, Department of Geological Sciences, and Seismograph Station at Berkeley. The Division of Mines furnished $1,500 in 1957-58 to the University's Division of Mineral Technology in support of research on clay and ceramic materials, and $1,000 to members of the University's geological staff doing research on age dating of California rock formations. All these cooperative efforts yielded reports which the Division of Mines has published or which are in press.

The Division of Mines has been allotted the annual sum of $8,000 for purchase of geological and mineral resources maps and reports of value to the mineral industries, in compiling the State Geologic Map, and for publication. Most of this sum has gone to students who have completed maps and reports for the master's and doctor's degrees in the geological sciences; some to university professors to assist in special research, and a small proportion to encourage other professional geologists to undertake and complete worthwhile projects. The sums paid each geologist are nominal, and the state has received a great deal of very valuable basic work in geology and mineral resources at extremely low cost. In many cases the Division has been able to suggest a project which will be of value and thus to direct research toward work that needs doing.

Considerable time was spent by one Division mining geologist during the fiscal year 1957-58 at the California Academy of Sciences in setting up the M. Vonsen collection of minerals. Exhibit specimens were selected, and suggestions were given to the Exhibits Department for displaying the minerals. This was a continuation of many years of cooperative work between the Division of Mines and the California Academy of Sciences.

RESEARCH LEGISLATION AND INVESTIGATION

The State Legislature, at its 1957 session, indicated its intent to establish a policy for more minerals research by the State Division of Mines. This policy, and a level of expenditure, was expressed in A. B. 1607 which provided "the sum of five hundred thousand dollars ($500,000) commencing with the 1958-59 Fiscal Year" * * * "for basic research and field studies in connection with the activities of the Division." This bill was vetoed by the Governor but the Division of Mines staff did a great deal of work in preparing a preliminary program for basic research and field studies in an integrated 5-year research plan.

Recognizing the need for "Appropriate research and field studies on all phases of the mining and mineral industry for the proper development and utilization of our mineral resources," Senate Concurrent Resolution 84 was passed, with no funds provided, directing the State Department of Natural Resources and the University of California to "prepare a program and recommendations jointly for presentation to the Legislature at the convening of its 1958 session on needed basic research and field studies regarding minerals and the mineral industries."

In response to this resolution, the Director of Natural Resources requested the Chief, Division of Mines, to cooperate with the University

of California in preparation of such a joint report. The chairman of the State Mining Board held open meetings for discussion of research problems at San Francisco and Los Angeles. At these meetings, all-day discussions were held on the subject of mineral research in the State of California, attended by representatives of industry and staff members of a number of universities in the state. A series of talks on the subjects of minerals research in California was presented by the Chief, Division of Mines, and Staff to the Mineral Industries section of the Commonwealth Club in San Francisco. At these meetings unofficial discussions of research programs were also presented by representatives of Stanford University School of Mineral Sciences, the U. S. Bureau of Mines, and the Division of Mineral Technology of the University of California.

On March 24, 1958, Director DeWitt Nelson of the State Department of Natural Resources and President Robert G. Sproul of the University of California submitted a joint interim report on studies and preliminary plans for basic research and field studies dealing with all phases of mining and the mineral industries to the Legislature. This report stated the policies, the broad areas of basic research and field studies, and the general types of organization proposed to achieve the objectives outlined in S. C. R. 84. It deferred presentation of budgets to implement these plans until the February 1959 session of the Legislature. The Sproul-Nelson report stated that:

"California's annual mineral production has now reached the value of $1.6 billion dollars, a source of new wealth second only to agricultural products. Most of the readily accessible and obvious mineral deposits in the State have been discovered and are being exploited. If new sources of mineral raw materials are to be located and developed, all modern methods of exploration and field studies must be employed. Basic research involving detailed geologic mapping of rock formations and mineral deposits, development and application of geophysical and geochemical methods, and fundamental studies of the origin of ore deposits can lead to the development of new and more efficient exploration tools. Improvement in mining and production methods through research in cheaper and more efficient drilling and extraction practices can increase yield of valuable mineral products. Basic research in beneficiation of ores, and in methods of concentrating and separating many types of nonmetallic raw materials is leading to the successful exploitation of deposits heretofore considered uneconomic. Knowledge of the uses of minerals by industry in California, and of the specifications required by industry, is a fruitful field for research. Research in this field of mineral utilization leads to the development of new markets and new industries, and to increased use of mineral raw materials produced in California."

Through regular channels, the Division has prepared a 1959-60 budget request which includes $111,000 for modernization of laboratory facilities and minimum personnel needed to initiate a program of minerals research.

Reference should be made to the October 1958 number of the *California Journal of Mines and Geology* for a more complete account of basic research needs and proposed program.

CONCLUSIONS

California's population has been growing at a tremendous rate in the past several years and all authorities predict continued rapid growth. Industrial development has kept pace but, in order to do so, has drawn more and more heavily on the resources of raw mineral materials in the state. For the past 10 years the value of mineral production has exceeded one billion dollars annually and has been in ex-

cess of 1½ billion for each of the past 2 years. Declines have been registered in some mineral commodities—notably, most of the metals, natural gas, and petroleum—and imports of mineral materials have been increasing.

If California is to maintain its expanding economy, exploration and development of its mineral resources must be accelerated. In this area, the Division of Mines has been able to materially assist the mineral industries by providing complete, authoritative information service, by mapping rock formations, mineral deposits, and mines, and by publishing scientific reports which have led to the discovery of new deposits and new and better utilization of known sources within the state. After the mineral fuels (77 percent), the greatest value of the state's mineral products is in the nonmetallic or industrial minerals (20 percent). Resources of the fuels are declining and more must be imported, but California has vast resources of borates, cement, diatomite, limestone, magnesium compounds, potash, salt, sand and gravel, and stone; all of which are basic to industry and construction. The development of deposits of these raw materials within the state brings new wealth to California and directly and indirectly provides jobs for our increasing population.

The investment by the state—very small in comparison with the value of mineral production—in support of the work of its Division of Mines has considerably aided the development of basic industry and construction by increasing local sources of mineral raw materials and extending their wise utilization. The program of the Division should be continued at a soundly expanding rate, to extend the scope of its minerals information service, to provide more critical, basic geologic mapping, and to permit the basic research so necessary in the exploration for new material deposits. The greatest immediate need of the Division is for modernization of its laboratory facilities and field equipment, and for the addition of the highly trained, technical, geological, and engineering personnel required to maintain the program of the Division of Mines at the highest and most useful level.

CALIFORNIA MINERAL COMMODITIES IN 1956 AND 1957*

By Henry H. Symons ** and Fenelon F. Davis **

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* Manuscript submitted for publication September 1958.

** Mining Engineer and Mining Geologist, respectively, California Division of Mines.

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PRODUCTION OF MINERALS IN CALIFORNIA DURING 1956 AND 1957 *

The value of mineral production continued to increase through 1956, and reached a new all-time high point in 1957. The figure for 1957 was $1,652,348,069, an increase of 7 percent over the 1956 figure of $1,551,524,133. The 1956 figure was in turn a 6 percent increase over the $1,458,729,633 figure reported for 1955. Thus the string of peaks for the value of mineral production in California remained unbroken and was extended for the seventh consecutive year dating from 1950. The 1957 peak was somewhat surprising as this was generally known to be a year of declining production for nearly all major mineral commodities, including petroleum. Prices too, had softened in the nonmetallic branch of the mineral industry and had weakened substantially in the metals field. However, prices for crude petroleum, which had been increased during the first half of the year owing to unsettled political and economic conditions in the Middle East oil-producing countries, held firm throughout the year. This resulted in a 12.6 percent increase in the value of California petroleum production. As petroleum is the factor that controls the value of California mineral production, the total value for the entire state output was increased proportionally.

The details of the 1957 mineral production are presented in a table on page 17.

In 1956 the value of California mineral production exceeded the billion and a half dollar mark for the first time. Petroleum production decreased 1 percent, but increased prices during the year resulted in an increase of 3.6 percent in value of the product.

Chromite, copper, iron ore, lead, and silver and zinc production increased, sustaining the output of the metals group. Copper and silver were produced as by-products of tungsten and lead mining, respectively.

Gold production dropped 23 percent, reflecting the strike-curtailed operations at the large Empire Star lode gold mines in Grass Valley

* Based on data compiled by the U. S. Bureau of Mines in cooperation with the California Division of Mines.

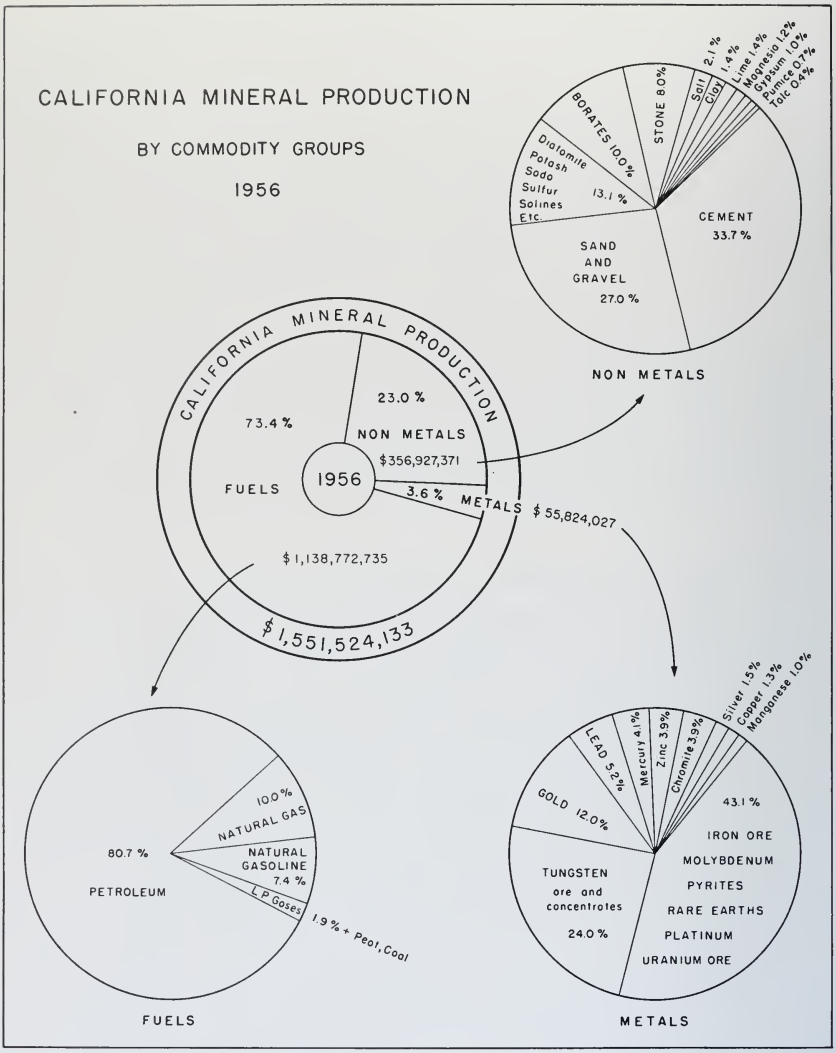

FIGURE 1.

during the second half of 1956. Mercury production dropped, although the price per flask averaged about $260 for the year. Production was suspended at the Mount Jackson mine in favor of an exploration program.

The production of tungsten concentrates was off 15 percent. This drop was the result of a time lag between the completion of the original U. S. Government purchase program and the initiation in July 1956 of a new purchase program at a lower unit price. Funds were lacking, also, to carry the new program through the remainder of the year. The production of low-grade manganese ore practically ceased with the completion of the U. S. Government purchasing program late in 1955.

Table 1. California mineral production in 1956.[1]

Mineral commodity	Amount	Value in dollars
Boron minerals, finished products, short tons	568,087	35,721,961
Cement, barrels	39,289,586	120,511,049
Chromite ore and concentrates, short tons	27,082	2,191,956
Clay, raw, short tons	2,981,595	†5,182,746
Copper, short tons	859	730,150
Gold, fine ounces	193,816	6,783,560
Gypsum, short tons	1,399,390	3,401,606
Iron ore, long tons	2,414,277	*
Lead, short tons	9,296	2,918,944
Lime, short tons	302,479	5,077,951
Magnesium compounds, short tons	66,007	4,531,777
Manganese ore and concentrates 35% or more Mn, short tons	6,595	595,001
Manganese concentrates, short tons	293	19,630
Mercury, flasks	9,017	2,343,699
Natural gas, M cubic feet	504,458,000	113,503,000
Natural gasoline plus cycle products, gallons	876,902,000	84,615,000
Liquid petroleum gases, gallons	410,232,000	21,332,000
Peat, short tons	18,918	214,735
Perlite, short tons	15,119	134,861
Petroleum, barrels	350,754,000	918,975,000
Pumice, pumicite, volcanic cinders, short tons	634,356	2,333,809
Salt, short tons	1,444,211	7,605,764
Sand and gravel, short tons	86,447,000	96,526,000
Silver, fine ounces	938,139	849,063
Stone, miscellaneous, short tons	32,583,370	‡28,753,742
Talc, soapstone, pyrophyllite, short tons	153,710	1,419,227
Tungsten concentrates, 60% WO_3, short tons	3,719	13,449,378
Uranium ore, U_3O_8 content, pounds	1,903	5,160
Zinc, short tons	8,049	2,205,426
Unapportioned*		69,591,938
TOTAL VALUE		$1,551,524,133

[1] Compiled by the U. S. Bureau of Mines in cooperation with the California Division of Mines.

* Unapportioned [includes asbestos, barite, bromine, calcium chloride, carbon dioxide, coal (lignite), diatomite, feldspar, gem stones, iodine, iron ore, lithium compounds, magnesite, mica (sericite), molybdenum concentrates, platinum group metals, potassium salts, pyrites, rare earth concentrates, slate, sodium salts, strontium minerals, sulfur ore, by-product sulfur].

† The total value of clay was $6,137,517; from this was taken the value of clay sold or used in cement, $954,771, leaving the total of $5,182,746.

‡ Total value of stone was $46,108,652; from this was taken the value of limestone used in lime and in cement, $17,354,910; leaving the total of $28,753,742.

A noteworthy expansion of production facilities was observed in the nonmetallic field during 1956. The conversion of the huge sodium borate deposit in eastern Kern County from an underground to an open-pit mining operation was begun. A new dry-process cement plant was completed near Mojave in eastern Kern County, and a new wet-process plant was under construction in western San Bernardino County. An extensive residual deposit of red-burning clay was discovered near Corona, Riverside County, and the erection of a heavy clay products plant near the deposit was started.

Increases in production and value over 1955 were registered also for the following structural and industrial minerals: barite, borates, calcium chloride, diatomite, gypsum, iodine, lime, magnesium compounds, potassium salts, salt, sand and gravel, sodium carbonate, sodium sulfate, and stone.

MINERAL PRODUCTION IN THE COUNTIES OF CALIFORNIA DURING 1956

The total mineral production of the state was composed of mineral contributions from each of its 58 counties. The oil producing counties—

Table 2. Value of 1956 mineral production by counties.

County	Value (dollars)	County	Value (dollars)
Alameda	19,180,754	Placer	563,314
Alpine*	--	Plumas	154,386
Amador	1,633,536	Riverside	39,477,680
Butte	2,559,164	Sacramento	18,136,327
Calaveras	11,466,710	San Benito	5,163,927
Colusa	406,861	San Bernardino	81,932,310
Contra Costa	5,174,878	San Diego	7,281,856
Del Norte	599,216	San Francisco	617,903
El Dorado	2,282,684	San Joaquin	6,262,844
Fresno	123,483,407	San Luis Obispo	10,812,246
Glenn	1,910,200	San Mateo	11,110,082
Humboldt	1,734,711	Santa Barbara	101,973,862
Imperial	2,446,840	Santa Clara	24,782,941
Inyo	17,239,485	Santa Cruz	7,631,707
Kern	337,211,064	Shasta	1,531,280
Kings	12,257,020	Sierra	377,425
Lake	849,297	Siskiyou	2,165,914
Lassen	656,227	Solano	11,112,903
Los Angeles	334,277,226	Sonoma	3,595,124
Madera	1,619,024	Stanislaus	782,414
Marin	2,339,295	Sutter	2,215,262
Mariposa	234,594	Tehama	667,606
Mendocino	436,245	Trinity	540,620
Merced	1,478,685	Tulare	3,022,299
Modoc	429,459	Tuolumne	4,151,969
Mono	4,335,082	Ventura	158,526,508
Monterey	28,302,774	Yolo	1,318,930
Napa	1,647,973	Yuba	3,651,441
Nevada	1,454,234	Not distributed by county†	6,442,543
Orange	117,873,865	TOTAL VALUE	$1,551,524,133

* Alpine County mineral production value is included with the "Not distributed by county" figures.
† Includes value of production from Alpine County, and also value of commodities not reported by county.

Kern, Los Angeles, Ventura, Orange, Fresno and Santa Barbara—played a dominant role in mineral production and occupied the first six places in output and value.

Two desert counties, San Bernardino and Riverside, with a diversified mineral output, were next in line. Monterey, a relative newcomer in the oil-producing ranks, entrenched itself in ninth place which it attained in 1955. Santa Clara County, the leading cement producer, ranked tenth.

Alameda County, site of extensive salt ponds on southern San Francisco Bay, was eleventh. It was closely followed by Sacramento County whose chief products are natural gas and gold; and by Inyo, an eastern Sierra and Basin Ranges county with a highly diversified mineral production.

MINERAL PRODUCTION IN THE COUNTIES OF CALIFORNIA DURING 1957

All 58 counties of the state contributed to the total mineral production in 1957. Kern, followed closely by Los Angeles, led all counties in value of mineral output for the third successive year. Kern and Los Angeles are the two principal petroleum producing counties and the value of their individual output is frequently double that of their nearest rivals. They were followed by four other oil-producing counties —Ventura, Orange, Fresno, and Santa Barbara.

Table 3. Mineral production by counties, 1956.

Product	Quantity	Value
Alameda County		
Clay (miscellaneous), short tons	50,057	$64,522
Sand and gravel, short tons	9,838,805	11,339,907
Stone (miscellaneous), short tons	1,218,764	784,940
Unapportioned*		6,991,385
Total value		$19,180,754

* Includes bromine, magnesium compounds and salt.

Alpine County

Mineral output of Alpine County consisted of sand and gravel, sulfur ore, and tungsten concentrates.

Amador County

Clay (fire), short tons	235,830	$764,963
Unapportioned*		868,573
Total value		$1,633,536

* Includes coal (lignite), copper, gemstones, gold, lead, sand and gravel, silver, and stone.

Butte County

Gold, fine ounces	72	$2,520
Natural gas, M cubic feet	5,677,000	1,419,000
Sand and gravel, short tons	694,127	757,489
Silver, fine ounces	6	5
Unapportioned*		380,150
Total value		$2,559,164

* Includes chromite and stone.

Calaveras County

Mineral output of Calaveras County consisted of cement, clay (fire), copper, gem stones, gold, sand and gravel, silver and tungsten concentrates valued at $11,466,710.

Colusa County

Sand and gravel, short tons	158,900	$185,458
Unapportioned*		221,403
Total value		$406,861

* Includes gemstones, natural gas, and stone (sandstone).

Contra Costa County

Sand and gravel, short tons	196,809	$211,841
Stone (miscellaneous), short tons	2,375,230	3,211,808
Unapportioned*		1,751,229
Total value		$5,174,878

* Includes clay (miscellaneous), natural gas, perlite, potash salts, sulfur and hydrogen sulfide (recovered from oil refinery gases).

Del Norte County

Chromite, short tons	2,153	$210,159
Sand and gravel, short tons	165,920	188,394
Stone (miscellaneous), short tons	118,685	192,857
Unapportioned*		7,806
Total value		$599,216

* Unapportioned includes copper, mercury, and silver.

Table 3. Mineral production by counties, 1956.—Continued.

Product	Quantity	Value
El Dorado County		
Sand and gravel, short tons	187,612	$194,234
Unapportioned*		2,088,450
Total value		$2,282,684

* Includes copper, gold, lead, lime, limestone, silver, slate, stone (miscellaneous), tungsten concentrates, and zinc.

Fresno County		
Mercury, flasks	26	$6,758
Natural gas, M cubic feet	34,243,000	7,396,000
Natural gasoline, gallons	64,692,000	6,243,000
Liquefied petroleum gases, gallons	61,289,000	3,187,000
Petroleum, barrels	35,980,000	104,449,000
Sand and gravel, short tons	997,527	1,170,024
Stone (miscellaneous), short tons	143,953	364,355
Tungsten concentrates, units	1,672	97,142
Unapportioned*		507,128
Total value		$123,483,407

* Includes chromite, clay (miscellaneous), gem stones, gold, pumice, and silver.

Glenn County		
Natural gas, M cubic feet	6,077,000	$1,519,000
Unapportioned*		391,200
Total value		$1,910,200

* Includes chromite, sand and gravel.

Humboldt County		
Sand and gravel, short tons	1,109,393	$1,122,295
Stone (miscellaneous), short tons	34,835	44,712
Unapportioned*		567,704
Total value		$1,734,711

* Includes chromite, copper, gem stones, natural gas, and silver.

Imperial County		
Manganese ore and concentrate, short tons	402	$32,330
Sand and gravel, short tons	588,693	517,616
Stone (miscellaneous), short tons	47,285	50,965
Unapportioned*		1,845,929
Total value		$2,446,840

* Includes gem stones, gold, gypsum, mica schist, pumice, silver, and uranium ore.

Inyo County		
Clay (bentonite and fullers earth), short tons	9,894	$57,499
Copper, pounds	1,255,500	533,588
Gold, fine ounces	1,760	59,710
Lead, pounds	18,523,400	2,908,174
Pumice, pumicite and volcanic cinders, short tons	108,614	650,539
Sand and gravel, short tons	164,791	148,830
Silver, fine ounces	853,134	772,129
Stone (miscellaneous), short tons	11,580	23,739
Talc and pyrophyllite, short tons	65,157	609,484
Tungsten concentrates, units	124,283	7,556,340
Zinc, pounds	16,044,800	2,198,138
Unapportioned*		1,721,315
Total value		$17,239,485

* Includes asbestos, barite, borates, gem stones, molybdenum concentrates, perlite, sodium carbonate, and uranium ore.

Table 3. Mineral production by counties. 1956.—Continued.

Product	Quantity	Value
Kern County		
Clay (miscellaneous and oil well drilling), short tons	49,596	$208,016
Copper, pounds	300	127
Gold, fine ounces	4,533	158,655
Gypsum, short tons	426,608	769,264
Lead, pounds	500	79
Natural gas, M cubic feet	78,148,000	16,880,000
Natural gasoline, gallons	211,782,000	20,435,000
Liquefied petroleum gases, gallons	168,686,000	8,772,000
Petroleum, barrels	96,485,000	244,493,000
Sand and gravel, short tons	1,106,645	1,807,330
Silver, fine ounces	15,232	13,786
Stone (miscellaneous), short tons	266,972	457,238
Tungsten concentrates, units	1,888	114,342
Zinc, pounds	900	123
Unapportioned*		43,102,104
Total value		$337,211,064

* Includes borates, cement, gem stones, pumicite, salt, sodium sulfate, and uranium ore.

Kings County		
Natural gas, M cubic feet	11,247,000	$2,429,000
Petroleum, barrels	2,437,000	7,722,000
Unapportioned*		2,106,020
Total value		$12,257,020

* Includes gypsum, mercury, natural gasoline, liquefied petroleum gases, and sand and gravel.

Lake County		
Mercury, flasks	2,482	$645,121
Sand and gravel, short tons	187,461	170,972
Unapportioned*		33,204
Total value		$849,297

* Includes gem stones, manganese concentrate, pumice and volcanic cinders.

Lassen County		
Sand and gravel, short tons	447,182	$463,439
Unapportioned*		192,788
Total value		$656,227

* Includes stone (miscellaneous) and volcanic cinders.

Los Angeles County		
Clay (miscellaneous), short tons	475,528	$593,144
Natural gas, M cubic feet	95,409,000	20,608,000
Natural gasoline, gallons	272,785,000	26,314,000
Liquefied petroleum gases, gallons	57,556,000	2,993,000
Petroleum, barrels	92,024,000	243,036,000
Sand and gravel, short tons	28,904,482	30,807,859
Stone (miscellaneous), short tons	2,336,968	3,725,604
Unapportioned*		6,199,619
Total value		$334,277,226

* Includes cement, diatomite, gold, iodine, silver, sulfur (elemental), sulfur dioxide and hydrogen sulfide (recovered from oil refinery gases), and soapstone.

Madera County		
Natural gas, M cubic feet	3,190,000	$798,000
Sand and gravel, short tons	422,777	367,327
Unapportioned*		453,697
Total value		$1,619,024

* Includes copper, gold, pumice and pumicite, silver, stone (granite dimension stone), tungsten concentrates, and uranium ore.

Table 3. Mineral production by counties, 1956.—Continued.

Product	Quantity	Value
Marin County		
Stone (miscellaneous), short tons	1,305,859	$2,059,599
Unapportioned*		279,696
Total value		$2,339,295

* Includes clay (miscellaneous), gem stones, mercury, and sand and gravel.

Mariposa County		
Sand and gravel, short tons	90,862	$145,670
Unapportioned*		88,924
Total value		$234,594

* Includes copper, gem stones, gold, silver, slate, stone (miscellaneous), and tungsten concentrates.

Mendocino County		
Sand and gravel, short tons	536,273	$353,948
Stone (miscellaneous), short tons	41,655	53,975
Unapportioned*		28,322
Total value		$436,245

* Includes carbon dioxide gas, gem stones, and manganese ore.

Merced County		
Gold, fine ounces	27	$945
Sand and gravel, short tons	1,778,909	1,470,102
Silver, fine ounces	3	3
Unapportioned*		7,635
Total value		$1,478,685

* Includes gypsum, and mercury.

Modoc County		
Sand and gravel, short tons	213,460	$209,160
Stone (miscellaneous), short tons	44,266	66,399
Unapportioned*		153,900
Total value		$429,459

* Includes gem stones, peat, pumice, and volcanic cinders.

Mono County		
Sand and gravel, short tons	196,320	$169,770
Unapportioned*		4,165,312
Total value		$4,335,082

* Includes clay (miscellaneous), gem stones, gold, pumice and pumicite, silver, stone (miscellaneous), pyrophyllite, tungsten concentrates, and uranium ore.

Monterey County		
Petroleum, barrels	11,733,000	$18,890,000
Sand and gravel (including glass sand), short tons	667,299	2,062,709
Unapportioned*		7,350,065
Total value		$28,302,774

* Includes chromite, feldspar, gem stones, lime, magnesium salts from sea water, mercury, natural gas, salt, and stone (including some dimension stone).

Napa County		
Mercury, flasks	105	$27,292
Sand and gravel, short tons	92,558	101,264
Unapportioned*		1,519,417
Total value		$1,647,973

* Includes asbestos, chromite, diatomite, gem stones, perlite (crude), and stone (miscellaneous).

Table 3. Mineral production by counties, 1956.—Continued.

Product	Quantity	Value
Nevada County		
Gold, fine ounces	22,862	$800,170
Sand and gravel, short tons	75,507	87,367
Silver, fine ounces	7,483	6,772
Unapportioned*		559,925
Total value		$1,454,234

* Includes barite, and tungsten concentrates.

Orange County		
Clay (miscellaneous), short tons	49,210	$197,180
Natural gas, M cubic feet	26,989,000	5,830,000
Natural gasoline, gallons	111,852,000	10,793,000
Liquefied petroleum gases, gallons	18,132,000	943,000
Petroleum, barrels	37,051,000	95,147,000
Sand and gravel, short tons	4,094,469	4,347,366
Unapportioned*		616,319
Total value		$117,873,865

* Includes iodine, peat, salt, and stone (miscellaneous).

Placer County		
Chromite, short tons	122	$11,295
Sand and gravel, short tons	109,312	121,716
Unapportioned*		430,303
Total value		$563,314

* Includes asbestos, clay (fire), gem stones, gold, silver, stone (granite dimension stone), and tungsten concentrates.

Plumas County		
Sand and gravel, short tons	120,170	$109,243
Unapportioned*		45,143
Total value		$154,386

* Includes copper, gold, manganese ore, stone (miscellaneous), and silver.

Riverside County		
Clay, short tons	298,275	$960,460
Copper, pounds	2,700	1,148
Gold, fine ounces	3	105
Manganese ore and concentrates, short tons	4,757	433,913
Sand and gravel (includes glass sand), short tons	1,301,577	1,774,864
Silver, fine ounces	226	205
Stone (miscellaneous), short tons	962,290	1,391,041
Tungsten concentrates, units	23	1,399
Unapportioned*		34,914,545
Total value		$39,477,680

* Includes cement, gem stones, gypsum, and iron ore.

Sacramento County		
Gold, fine ounces	49,641	$1,737,435
Natural gas, M cubic feet	49,511,000	12,378,000
Sand and gravel, short tons	3,400,325	3,940,478
Silver, fine ounces	2,166	1,960
Stone (miscellaneous), short tons	7,886	17,631
Unapportioned*		60,823
Total value		$18,136,327

* Includes clay, and platinum.

Table 3. Mineral production by counties, 1956.—Continued.

Product	Quantity	Value
San Benito County		
Mercury, flasks	2,914	$757,407
Sand and gravel, short tons	158,961	119,779
Unapportioned*		4,286,741
Total value		$5,163,927

* Includes cement, chromite, gem stones, natural gas, petroleum, and stone (miscellaneous).

San Bernardino County		
Clay (miscellaneous and bentonite), short tons	41,807	$212,885
Copper, pounds	92,900	39,482
Gold, fine ounces	209	7,315
Lead, pounds	34,500	5,416
Pumice and volcanic cinders, short tons	59,208	87,908
Sand and gravel, short tons	4,436,478	4,462,583
Silver, fine ounces	3,671	3,323
Stone (including limestone and granite), short tons	352,668	1,987,820
Talc, short tons	58,081	700,022
Tungsten concentrates, units	16,496	977,837
Zinc, pounds	8,800	1,205
Unapportioned*		73,446,514
Total value		$81,932,310

* Includes borates, bromine, calcium chloride, cement, feldspar, gemstones, iron ore, lime, manganese ore, mercury, natural gas, perlite, petroleum, potash, rare earths, salt, sodium carbonate, sodium sulfate, and strontium minerals.

San Diego County		
Pyrophyllite, short tons	3,009	$7,259
Sand and gravel, short tons	3,231,171	5,375,035
Stone (including granite dimesion stone), short tons	400,753	1,347,940
Unapportioned*		551,622
Total value		$7,281,856

* Includes clay (miscellaneous), gem stones, gold, magnesium salts, salt, strontium minerals, and tungsten concentrates.

San Francisco County		
Sand and gravel, short tons	278,852	$184,240
Stone (miscellaneous), short tons	849,042	433,663
Total value		$617,903

San Joaquin County		
Natural gas, M cubic feet	15,588,000	$3,897,000
Sand and gravel, short tons	2,223,007	2,321,680
Other minerals		44,164
Total value		$6,262,844

San Luis Obispo County		
Chromite, short tons	10,169	$718,677
Mercury, flasks	117	30,411
Petroleum, barrels	2,423,000	7,256,000
Sand and gravel, short tons	730,215	646,315
Unapportioned*		2,160,843
Total value		$10,812,246

* Includes clay, gem stones, gypsum, manganese ore, natural gas, natural gasoline, liquefied petroleum gas, stone (including limestone), and sulfur (elemental from refineries).

San Mateo County		
Stone (miscellaneous), short tons	1,593,528	$1,803,299
Unapportioned*		9,306,783
Total value		$11,110,082

* Includes cement, gem stones, magnesium compounds, mercury, natural gas, petroleum, sand and gravel, and salt.

Table 3. Mineral production by counties, 1956.—Continued.

Product	Quantity	Value
Santa Barbara County		
Natural gas, M cubic feet	18,757,000	$4,052,000
Natural gasoline, gallons	45,144,000	4,356,000
Liquefied petroleum gases, gallons	16,040,000	834,000
Petroleum, barrels	29,006,000	77,882,000
Sand and gravel, short tons	751,565	952,563
Unapportioned*		13,897,299
Total value		$101,973,862
* Includes chromite, clay (miscellaneous), diatomite, mercury, and stone (miscellaneous).		
Santa Clara County		
Mercury, flasks	1,905	$495,148
Sand and gravel, short tons	1,499,194	1,216,835
Stone (miscellaneous), short tons	2,225,559	1,498,639
Unapportioned*		21,572,319
Total value		$24,782,941
* Includes cement, masonry cement, clay, gem stones, and magnesite.		
Santa Cruz County		
Sand and gravel, short tons	734,907	$768,918
Unapportioned*		6,862,789
Total value		$7,631,707
* Includes cement, potash salt, and stone (including limestone).		
Shasta County		
Sand and gravel, short tons	493,249	$633,325
Stone (miscellaneous), short tons	114,147	98,014
Volcanic cinders, short tons	19,233	50,125
Unapportioned*		749,816
Total value		$1,531,280
* Includes copper, gold, lead, pyrite, silver, and zinc.		
Sierra County		
Gold, fine ounces	10,654	$372,890
Silver, fine ounces	2,144	1,940
Other minerals		2,595
Total value		$377,425
Siskiyou County		
Chromite, short tons	2,354	$215,666
Gold, fine ounces	15,510	542,850
Pumice and volcanic cinders, short tons	360,280	744,077
Sand and gravel, short tons	407,384	519,503
Silver, fine ounces	37,404	33,853
Stone (miscellaneous), short tons	109,880	109,880
Other minerals		85
Total value		$2,165,914
Solano County		
Natural gas, M cubic feet	35,467,000	$8,867,000
Sand and gravel, short tons	853,394	868,800
Stone (miscellaneous), short tons	295,800	406,781
Other minerals		970,322
Total value		$11,112,903

Table 3. Mineral production by counties, 1956.—Continued.

Product	Quantity	Value
Sonoma County		
Stone (miscellaneous), short tons	1,525,384	$1,656,396
Unapportioned*		1,938,728
Total value		$3,595,124

* Includes clay (miscellaneous), mercury, natural gas, petroleum, and sand and gravel.

Stanislaus County		
Sand and gravel, short tons	795,322	$764,686
Unapportioned*		17,728
Total value		$782,414

* Includes chromite, clay (fire), gold, mercury and silver.

Sutter County

Mineral output of Sutter County consisted of clay, natural gas, and sand and gravel valued at $2,215,262.

Tehama County		
Chromite, short tons	474	$41,343
Stone (miscellaneous), short tons	10,725	32,175
Unapportioned*		$594,088
Total value		$667,606

* Includes natural gas, and sand and gravel.

Trinity County		
Chromite, short tons	40	$3,487
Manganese ore, short tons	507	44,722
Sand and gravel, short tons	201,277	250,012
Stone (miscellaneous), short tons	8,282	13,632
Unapportioned*		228,767
Total value		$540,620

* Includes copper, gold, mercury, and silver.

Tulare County		
Natural gas, M cubic feet	6,449,000	$1,612,000
Sand and gravel, short tons	559,922	716,186
Stone (including dimension granite), short tons	46,793	70,027
Tungsten concentrates, units	7,330	433,746
Unapportioned*		190,340
Total value		$3,022,299

* Includes barite, clay, gem stones, and petroleum.

Tuolumne County		
Sand and gravel, short tons	2,863,622	$2,292,751
Stone (including limestone), short tons	724,917	1,271,510
Unapportioned*		587,708
Total value		$4,151,969

* Includes gold, lime, silver, and tungsten concentrates.

Ventura County		
Clay, short tons	164,255	$199,192
Natural gas, M cubic feet	80,348,000	17,355,000
Natural gasoline, gallons	144,022,000	13,897,000
Liquefied petroleum gases, gallons	76,714,000	3,989,000
Petroleum, barrels	43,021,000	119,427,000
Sand and gravel, short tons	2,874,826	3,367,855
Unapportioned*		291,461
Total value		$158,526,508

* Unapportioned includes gypsum, and stone (miscellaneous).

Table 3. Mineral production by counties, 1956.—Continued.

Product	Quantity	Value
Yolo County		
Natural gas, M cubic feet	2,474,000	$618,000
Sand and gravel, short tons	686,162	632,609
Stone (miscellaneous), short tons	38,675	68,321
Total value		$1,318,930
Yuba County		
Sand and gravel, short tons	608,250	$959,442
Unapportioned*		2,691,999
Total value		$3,651,441

* Includes clay (fire), gold, platinum group metals, and silver.

Diversity of mineral production, rather than oil, is the important factor in San Bernardino County which ranked seventh. About 35 mineral products are commonly produced commercially from this desert county. Riverside, another desert county with a diverse mineral production, followed in eighth place.

Monterey, a large coastal county with potential mineral resources, has forged ahead rapidly during the past decade since the discovery of oil in 1945. This county now ranks ninth in value of mineral output. In tenth place is Santa Clara County, in which is located the largest cement mill in the world.

Table 4. Value of mineral production by counties, 1957.

County	Value (dollars)	County	Value (dollars)
Alameda	17,112,606	Placer	896,256
Alpine*	--	Plumas	538,919
Amador	1,209,898	Riverside	39,461,951
Butte	3,393,284	Sacramento	16,546,767
Calaveras	12,065,210	San Benito	7,801,824
Colusa	373,226	San Bernardino	77,362,801
Contra Costa	4,817,057	San Diego	7,562,239
Del Norte	929,262	San Francisco	194,890
El Dorado	2,390,198	San Joaquin	5,364,243
Fresno	134,767,707	San Luis Obispo	11,472,808
Glenn	4,929,056	San Mateo	11,660,381
Humboldt	2,565,261	Santa Barbara	108,905,564
Imperial	2,379,174	Santa Clara	27,501,823
Inyo	7,848,408	Santa Cruz	7,548,198
Kern	368,979,681	Shasta	2,098,480
Kings	11,825,970	Sierra	665,761
Lake	896,832	Siskiyou	1,965,302
Lassen	129,593	Solano	10,352,104
Los Angeles	327,061,838	Sonoma	4,309,538
Madera	1,801,286	Stanislaus	933,212
Marin	2,174,090	Sutter	502,609
Mariposa	144,545	Tehama	700,903
Mendocino	1,799,082	Trinity	1,649,368
Merced	1,120,195	Tulare	3,141,098
Modoc	748,629	Tuolumne	1,211,204
Mono	1,531,991	Ventura	202,605,322
Monterey	33,372,321	Yolo	1,357,951
Napa	1,231,909	Yuba	4,131,995
Nevada	198,944	Not distributed by county†	4,066,100
Orange	142,041,235	TOTAL VALUE	$1,652,348,069

* Alpine County mineral production value is included with the "Not distributed by county" figures.
† Includes value of production from Alpine County, and also value of commodities not reported by county.

Table 5. Mineral production by counties, 1957.

Product	Quantity	Value
Alameda County		
Clay, short tons	38,957	$30,002
Sand and gravel, short tons	6,881,916	8,382,005
Stone, short tons	1,004,739	721,943
Unapportioned*		7,978,657
Total value		$17,112,606
* Includes bromine, chromite, magnesium compounds and salt.		
Alpine County		
Mineral output of Alpine County consisted of sand and gravel, silver, and sulphur ore.		
Amador County		
Clay, short tons	143,898	$371,990
Sand and gravel, short tons	218,412	651,984
Unapportioned*		185,924
Total value		$1,209,898
* Includes coal, gold, silver, and stone.		
Butte County		
Natural gas, M cubic feet	8,807,000	$2,228,000
Sand and gravel, short tons	533,212	588,652
Stone, short tons	446,484	346,676
Unapportioned*		229,956
Total value		$3,393,284
* Includes chromite, gold, and gem stones.		
Calaveras County		
Copper, pounds	49,300	$14,839
Lead, pounds	200	29
Sand and gravel, short tons	96,524	335,557
Unapportioned*		11,714,785
Total value		$12,065,210
* Includes cement, clay, gem stones, gold, silver and stone.		
Colusa County		
Mineral output of Colusa County consisted of chromite, gem stones, mercury, natural gas, sand and gravel valued at $373,226.		
Contra Costa County		
Sand and gravel, short tons	435,479	$379,834
Stone, short tons	1,935,323	2,542,389
Unapportioned*		1,894,834
Total value		$4,817,057
* Includes clay, gem stones, natural gas, peat, sulfur (from petroleum refining).		
Del Norte County		
Chromite, short tons	3,075	$294,762
Sand and gravel, short tons	479,639	429,995
Stone, short tons	164,950	204,505
Total value		$929,262

Table 5. Mineral production by counties, 1957.—Continued.

Product	Quantity	Value
El Dorado County		
Copper, pounds	34,200	$10,294
Lead, pounds	35,600	5,091
Sand and gravel, short tons	277,231	289,059
Zinc, pounds	13,200	1,531
Unapportioned*		2,084,223
Total value		$2,390,198
* Includes chromite, gem stones, gold, limestone, lime, silver, slate, stone, and soapstone.		
Fresno County		
Gold, fine ounces	193	$6,755
Natural gas, M cubic feet	33,329,000	7,245,000
Natural gasoline, gallons	78,486,000	7,571,000
Liquefied petroleum gases, gallons	36,367,000	1,901,000
Petroleum, barrels	34,459,000	111,089,000
Sand and gravel, short tons	1,433,981	1,633,781
Silver, fine ounces	27	24
Stone, short tons	7,886,667	4,596,479
Unapportioned*		724,668
Total value		$134,767,707
* Includes chromite, clay, mercury, pumicite.		
Glenn County		
Natural gas, M cubic feet	17,964,000	$4,545,000
Sand and gravel, short tons	433,251	351,052
Unapportioned		33,004
Total value		$4,929,056
Humboldt County		
Sand and gravel, short tons	1,595,312	$1,530,941
Stone		440,401
Unapportioned*		593,919
Total value		$2,565,261
* Includes chromite, copper, gem stones, gold, lead, natural gas, and silver.		
Imperial County		
Copper, pounds	1,400	$422
Gold, fine ounces	1	35
Lead, pounds	3,300	472
Sand and gravel, short tons	618,689	438,654
Silver, fine ounces	200	181
Stone, short tons	33,606	43,258
Zinc, pounds	1,400	162
Unapportioned*		1,895,990
Total value		$2,379,174
* Includes gem stones, gypsum, manganese ore, mica, and pumice.		
Inyo County		
Clay, short tons	8,527	$47,000
Copper, pounds	1,630,300	490,720
Gold, fine ounces	693	24,255
Lead, pounds	6,829,500	976,618
Sand and gravel, short tons	163,853	134,304
Silver, fine ounces	450,511	407,735
Stone, short tons	7,303	41,296
Talc, short tons	62,247	767,139
Zinc, pounds	5,908,200	685,351
Unapportioned*		4,273,990
Total value		$7,848,408
* Includes asbestos, borates, gem stones, manganese ore, molybdenum, perlite, pumice, sodium carbonate, and tungsten concentrates.		

Table 5. Mineral production by counties, 1957.—Continued.

Product	Quantity	Value
Kern County		
Clay, short tons	44,300	$268,437
Copper, pounds	100	30
Gypsum, short tons	472,953	814,805
Natural gas, M cubic feet	86,022,000	18,854,000
Natural gasoline, gallons	192,348,000	18,554,000
Liquefied petroleum gases, gallons	89,116,000	4,657,000
Petroleum, barrels	91,508,000	273,746,000
Sand and gravel, short tons	859,669	1,282,914
Stone, short tons	234,079	487,441
Unapportioned*		50,315,054
Total value		$368,979,681

* Includes borates, cement, gem stones, gold, limestone, pumice and pumicite, salt, silver, sodium carbonate, tungsten, and uranium ore.

Kings County		
Natural gas, M cubic feet	9,187,000	$2,069,000
Petroleum, barrels	2,103,000	7,171,000
Sand and gravel, short tons	588,027	300,856
Stone, short tons	26,336	52,059
Unapportioned*		2,233,055
Total value		$11,825,970

* Includes gypsum, mercury, natural gasoline, liquefied petroleum gases.

Lake County		
Sand and gravel, short tons	149,027	$126,479
Unapportioned*		770,353
Total value		$896,832

* Includes gem stones, manganese concentrate, mercury, volcanic cinders, stone, and sulfur ore.

Lassen County

Mineral output of Lassen County consisted of volcanic cinders, sand and gravel, stone, and uranium ore valued at $129,593.

Los Angeles County		
Clay, short tons	518,657	$650,225
Natural gas, M cubic feet	84,086,000	18,307,000
Natural gasoline, gallons	196,140,000	18,920,000
Liquefied petroleum gases, gallons	90,873,000	4,749,000
Petroleum, barrels	81,573,000	251,984,000
Sand and gravel, short tons	19,536,601	21,996,249
Stone, short tons	2,605,323	3,953,876
Unapportioned*		6,501,488
Total value		$327,061,838

* Includes cement, diatomite, gold, gem stones, iodine, silver, elemental sulfur-sulfur dioxide-hydrogen sulfide recovered from petroleum refining, and soapstone.

Madera County		
Sand and gravel, short tons	1,159,920	$818,618
Unapportioned*		982,668
Total value		$1,801,286

* Includes copper, gem stones, gold, natural gas, pumice and pumicite, silver, stone, tungsten ore, and uranium ore.

Marin County		
Sand and gravel, short tons	37,238	$45,670
Unapportioned*		2,128,420
Total value		$2,174,090

* Includes clay, mercury, and stone.

Table 5. Mineral production by counties, 1957.—Continued.

Product	Quantity	Value
Mariposa County		
Sand and gravel, short tons	59,238	$96,652
Unapportioned*		47,893
Total value		$144,545

* Includes gold, silver, slate, tungsten concentrates.

Mendocino County		
Sand and gravel, short tons	1,108,268	$1,528,826
Unapportioned*		270,256
Total value		$1,799,082

* Includes chromite, gem stones, stone.

Merced County		
Sand and gravel, short tons	1,456,297	$1,116,120
Unapportioned		4,075
Total value		$1,120,195

Modoc County		
Sand and gravel, short tons	508,188	$506,126
Unapportioned*		242,503
Total value		$748,629

* Includes gem stones, peat, and pumice.

Mono County		
Copper, pounds	6,500	$1,957
Gold, fine ounces	75	2,625
Lead, pounds	12,800	1,830
Sand and gravel, short tons	179,939	152,244
Unapportioned*		1,373,335
Total value		$1,531,991

* Includes clay, pumice, pyrophyllite, and tungsten concentrates.

Monterey County		
Natural gas, M cubic feet	4,229,000	$918,000
Petroleum, barrels	11,845,000	23,659,000
Sand and gravel, short tons	887,770	1,538,859
Stone, short tons	70,674	284,407
Unapportioned*		6,972,055
Total value		$33,372,321

* Includes chromite, feldspar, gem stones, lime, magnesium compounds, mercury, salt.

Napa County

Mineral output of Napa County consisted of asbestos, chromite, diatomite, mercury, perlite, sand and gravel, and stone valued at $1,231,909.

Nevada County		
Gold, fine ounces	3,816	$133,560
Sand and gravel, short tons	61,837	56,568
Silver, fine ounces	993	899
Unapportioned*		7,917
Total value		$198,944

* Includes barite and tungsten concentrate.

Table 5. Mineral production by counties, 1957.—Continued.

Product	Quantity	Value
Orange County		
Clay, short tons	47,965	$241,046
Natural gas, M cubic feet	33,339,000	7,234,000
Natural gas gasoline, gallons	79,332,000	7,653,000
Liquid petroleum gases, gallons	36,755,000	1,921,000
Petroleum, barrels	39,812,000	120,353,000
Sand and gravel, short tons	5,007,988	4,571,099
Unapportioned*		68,090
Total value		$142,041,235

* Includes iodine, peat, and salt.

Placer County		
Gold, fine ounces	254	$8,890
Sand and gravel, short tons	283,880	384,864
Silver, fine ounces	26	24
Unapportioned*		502,478
Total value		$896,256

* Includes chromite, clay, stone.

Plumas County		
Copper, pounds	2,900	$873
Gold, fine ounces	283	9,905
Sand and gravel, short tons	389,880	441,843
Silver, fine ounces	188	170
Unapportioned*		86,128
Total value		$538,919

* Includes chromite, manganese ore, mica (scrap), and stone.

Riverside County		
Clay, short tons	292,418	$965,203
Copper, pounds	2,600	782
Gold, fine ounces	7	245
Sand and gravel, short tons	2,578,043	2,835,492
Silver, fine ounces	7	6
Stone, short tons	492,472	2,010,850
Unapportioned*		33,649,373
Total value		$39,461,951

* Includes cement, gem stones, gypsum, iron ore, manganese ore, petroleum.

Sacramento County		
Natural gas, M cubic feet	42,325,000	$10,708,000
Sand and gravel, short tons	3,562,043	4,384,330
Unapportioned*		1,455,437
Total value		$16,546,767

* Includes clay, gold, platinum and allied metals, silver, stone.

San Benito County		
Sand and gravel, short tons	437,160	$363,882
Unapportioned*		7,437,942
Total value		$7,801,824

* Includes cement, chromite, clay (bentonite), gem stones, mercury, natural gas, petroleum, stone.

Table 5. Mineral production by counties, 1957.—Continued.

Product	Quantity	Value
San Bernardino County		
Clay, short tons	43,299	$225,105
Copper, pounds	6,900	2,077
Gold, fine ounces	31	1,085
Lead, pounds	31,000	4,433
Sand and gravel, short tons	4,458 056	4,519,418
Silver, fine ounces	2,980	2,697
Stone, short tons	711,875	2,862,807
Talc, short tons	44,644	626,950
Zinc, pounds	15,100	1,752
Unapportioned*		69,116,477
Total value		$77,362,801

* Includes barite, borates, bromine, calcium chloride, cement, feldspar, fluorspar, gem stones, iron ore, lime, manganese ore, natural gas, perlite, petroleum, potash, pumice, rare earths, salt, sodium carbonate, sodium sulfate, tungsten concentrates.

San Diego County		
Sand and gravel, short tons	3,392,126	$5,472,388
Stone, short tons	600,401	1,502,262
Unapportioned*		587,589
Total value		$7,562,239

* Includes clay, gem stones, gold, magnesium compounds, salt, silver, strontium, pyrophyllite, tungsten concentrate.

San Francisco County		
Sand, short tons	343,729	$90,026
Stone, short tons	161,672	104,864
Total value		$194,890

San Joaquin County		
Natural gas, M cubic feet	13,104,000	$3,315,000
Sand and gravel, short tons	1,928,668	2,016,510
Unapportioned		32,733
Total value		$5,364,243

San Luis Obispo County		
Chromite, short tons	16,262	$1,174,508
Petroleum, barrels	2,331,000	7,952,000
Sand and gravel, short tons	471,466	737,859
Unapportioned*		1,608,441
Total value		$11,472,808

* Includes clay, gem stones, gypsum, manganese ore, mercury, natural gas, natural gas gasoline, liquid petroleum gases, stone, and elemental sulfur recovered from petroleum refining.

San Mateo County		
Sand and gravel, short tons	220,146	$146,718
Stone, short tons	1,572,153	2,194,272
Unapportioned*		9,466,109
Total value		$11,660,381

* Includes cement, gem stones, magnesium compounds, mercury, natural gas, petroleum, salt.

Santa Barbara County		
Natural gas, M cubic feet	25,568,000	$5,716,000
Natural gas gasoline, gallons	49,760,000	4,800,000
LP gases, gallons	23,054,000	1,205,000
Petroleum, barrels	27,895,000	84,313,000
Sand and gravel, short tons	462,384	558,333
Unapportioned*		12,313,231
Total value		$108,905,564

* Includes chromite, clay, diatomite, mercury, stone.

Table 5. Mineral production by counties, 1957.—Continued.

Product	Quantity	Value
Santa Clara County		
Mercury, flasks	2,529	$624,613
Sand and gravel, short tons	1,252,989	1,355,470
Stone, short tons	2,236,411	1,836,043
Unapportioned*		23,685,697
Total value		$27,501,823
* Includes cement, masonry cement, clay, gem stones, limestone.		
Santa Cruz County		
Sand and gravel, short tons	752,472	$813,561
Unapportioned*		6,734,637
Total value		$7,548,198
* Includes cement, gem stones, limestone, potash, stone.		
Shasta County		
Sand and gravel, short tons	1,022,124	$1,263,505
Stone, short tons	63,490	49,647
Unapportioned*		785,328
Total value		$2,098,480
* Includes chromite, gold, volcanic cinders, pyrite.		
Sierra County		
Gold, fine ounces	16,472	$576,520
Sand and gravel, short tons	48,694	57,419
Silver, fine ounces	3,243	2,935
Stone, short tons	5,500	28,875
Zinc, pounds	100	12
Total value		$665,761
Siskiyou County		
Chromite, short tons	1,859	$170,021
Copper, pounds	7,900	2,378
Gold, fine ounces	19,424	679,840
Pumice and volcanic cinder, short tons	243,260	470,483
Sand and gravel, short tons	369,768	480,540
Silver, fine ounces	45,447	41,132
Stone, short tons	76,160	119,283
Unapportioned		1,625
Total value		$1,965,302
Solano County		
Natural gas, M cubic feet	32,612,000	$8,251,000
Sand and gravel, short tons	714,700	883,160
Unapportioned*		1,217,944
Total value		$10,352,104
* Includes clay, stone.		
Sonoma County		
Stone, short tons	2,373,390	$2,401,235
Unapportioned*		1,908,303
Total value		$4,309,538
* Includes chromite, clay, mercury, natural gas, petroleum, sand and gravel.		
Stanislaus County		
Sand and gravel, short tons	877,863	$908,995
Unapportioned*		24,217
Total value		$933,212
* Includes chromite, clay.		

Table 5. Mineral production by counties, 1957.—Continued.

Product	Quantity	Value
Sutter County		
Sand and gravel, short tons	138,965	$111,960
Unapportioned*		390,649
Total value		$502,609

* Includes clay and natural gas.

Tehama County		
Chromite, short tons	678	$60,164
Sand and gravel, short tons	268,587	387,168
Unapportioned*		253,571
Total value		$700,903

* Includes natural gas, stone.

Trinity County		
Sand and gravel, short tons	1,180,123	$925,032
Stone, short tons	802,189	587,258
Unapportioned*		137,078
Total value		$1,649,368

* Includes chromite, copper, gold, mercury, silver.

Tulare County		
Natural gas, M cubic feet	6,880,000	$1,741,000
Sand and gravel, short tons	1,530,650	1,022,818
Unapportioned*		377,280
Total value		$3,141,098

* Includes barite, clay, petroleum, stone, tungsten concentrates.

Tuolumne County

Mineral output of Tuolumne County consisted of chromite, gem stones, gold, lime, sand and gravel, stone valued at $1,211,204.

Ventura County		
Clay, short tons	163,369	$196,732
Natural gas, M cubic feet	96,810,000	26,059,000
Natural gas gasoline, gallons	226,980,000	21,895,000
LP gases, gallons	105,161,000	5,496,000
Petroleum, barrels	46,530,000	150,128,000
Sand and gravel, short tons	3,109,905	3,129,115
Stone, short tons	232,717	613,026
Unapportioned		88,449
Total value		$202,605,322

Yolo County		
Natural gas, M cubic feet	2,316,000	$586,000
Sand and gravel, short tons	737,678	754,951
Stone, short tons	8,300	17,000
Total value		$1,357,951

Yuba County		
Sand and gravel, short tons	663,524	$692,749
Stone, short tons	818,302	533,278
Unapportioned*		2,905,968
Total value		$4,131,995

* Includes clay, copper, gold, platinum, silver.

MINERAL COMMODITIES OF CALIFORNIA DURING 1956 AND 1957

Antimony

Although stibnite, or antimony sulfide (Sb_2S_3), occurs at numerous localities throughout California, probably less than 1000 tons of antimony metal has been produced from California deposits between 1887 and 1957.

During 1956 and 1957 no antimony was reported mined or shipped from California mines. An undetermined quantity of recoverable antimony is contained in the lead-zinc concentrates from the Darwin and Shoshone mines in Inyo County.

Asbestos

Serpentine, the host rock for asbestos, is widely distributed throughout California. Numerous deposits of both chrysotile and amphibole (tremolite) asbestos are known but commercial production has been intermittent. Production between 1887 and 1955 has been approximately 5,700 tons, valued at $218,000.

The 1956 California output of both amphibole and chrysotile asbestos showed a marked decrease from the 1955 production. The material shipped in 1956 was a small tonnage of chrysotile asbestos from Napa County, amphibole asbestos from Inyo County, and tremolite from Placer County. In addition, a small tonnage of tremolite was mined but not shipped from Shasta County.

Some amphibole asbestos, with the exception of the tremolite, was used as filler; the tremolite went into acid filters and the chrysotile asbestos was sold as an additive to concrete.

In 1957 a small tonnage of chrysotile asbestos was shipped from Napa County, and a very small tonnage of amphibole asbestos was shipped from Inyo County.

Barite

Deposits of barite are widespread in California and production has been made from several of them. Between 1910 and 1952, production approximated 540,000 tons, valued at $3,650,000.

In 1956 the Barite King group of claims in Nine Mile Canyon, eastern Tulare County, were reopened by the Macco Corporation. The barite was mined from an open pit and transported by a fleet of four truck-trailer units to a new concentrating plant constructed at Linnie Station, Indian Wells Valley, Kern County. The plant was handling mine-run barite at the rate of 400 tons per day. Processed barite was transported from the concentrator to a blending plant at Rosamond, operated by the same company. Here, the barite was blended with other ingredients to produce drilling muds which are widely used in the oil industry to control the high pressures encountered in drilling oil and gas wells.

The barite shipped from California properties in 1956 showed a large increase over that mined in 1955. It came from one property in each of the following counties: Inyo, Nevada, and Tulare.

Most of the crude barite shipped from California mines was used in oil well drilling mud. Grinding mills handling barite are located in Berkeley, Compton, Emeryville, Fresno, Los Angeles, Merced, Oakland,

and Rosamond. A plant in Modesto manufactures barium chemicals and one plant in Oakland manufactures barium pigments.

Barite sold or used by producers dropped about 50 percent in 1957. The principal production came from the Barite King group of mines in Tulare County.

Boron Minerals

The largest known reserves of boron minerals in the world are located in the Mojave Desert region of southeastern California. Borax ($Na_2B_4O_7 \cdot 10H_2O$), kernite ($Na_2B_4O_7 \cdot 4H_2O$), colemanite ($Ca_2B_6O_{11} \cdot 5H_2O$), ulexite ($NaCaB_5O_9 \cdot 8H_2O$) and borate brines are principal sources of commercial production in the state.

The borates produced and shipped in California during 1956 totaled 568,087 short tons of finished products worth $35,721,961. Crude ore production was 944,950 short tons, in which the B_2O_3 content was 282,874 short tons. Production during 1956 and 1957 came from properties of two companies in San Bernardino County, and one property each in Inyo and Kern Counties.

In January 1956 the Pacific Coast Borax Company, Division of United States Borax and Chemical Corporation, initiated a program to convert their mines at Boron, eastern Kern County, from underground to open pit. Underground mining of the deposit started in 1927 and by 1956 the operations encompassed three adjoining mines, the Baker, West Baker, and Jenifer.

These mines were developed through vertical shafts. Mine superintendent Wamsley * stated:

"The first phase of conversion involved stripping about 125 feet of sedimentary beds which overlie the borate deposits. The overburden included sand and gravel, tuffaceous sandstone, sandstone, conglomerate, limestone and shale. The stripping was done under contract by the Isbell Construction Company who removed 10,000,000 tons of overburden at the rate of 25,000 tons per 2-shift day. The material was scarified and push-loaded into carryalls for transport to the dump area about one mile distant from the site of the pit. Stripping was still in progress at the end of 1956.

The open pit operation will eliminate selective mining and permit almost complete recovery of the ore. A new refinery also is under construction at Boron. The new refinery will utilize lower grade ore and will effect savings in transportation, since the present ore is shipped 150 miles by rail to the old refinery at Wilmington.

The Baker and West Baker mines used shrinkage stoping with three drum portable slushers mounted on a slide, and rail haulage with battery locomotives and three-ton cars. Drilling was with Jeffrey electric auger drills. Slopes or winzes were driven to follow the pitching beds. The open stopes were filled with sand through a drill hole. In the Jenifer mine, room and pillar stoping with one Joy 1PM and five 4JCM continuous miners is used. Haulage is with Joy 10SC eight-ton shuttle cars that dump into large vertical transfer raises that also provide some storage capacity. Jeffrey vibrating feeders take ore from the raises to feed the 30-in. Jeffrey conveyor belt system which brings the ore from all machines to the 1100 ft by 30-in Joy main winze conveyor. The main winze conveyor takes ore up a 20 percent incline to the crusher and automatic skip loader at the bottom of the shaft. On the surface the minus 4-in. ore is taken from bins to either a car-loading system . . . for transfer to the Boron mill or Wilmington, California refinery, or is stockpiled with a D8 dozer to equalize production and demand variations. Complete maintenance shops and parts warehouse are located under ground. Ground support, where needed, is mainly with Pattin roof bolts. A pressure ventilating system provided 20,000 CFM, or more, to each working face and was supplemented by a 20,000 CFM fan mounted on each continuous miner; this discharged behind line brattice through homemade 24-in. flexible tube."

* Wamsley, W. H., New developments in borax mining of Boron: Paper presented at American Mining Congress, Los Angeles, California, October 1956.

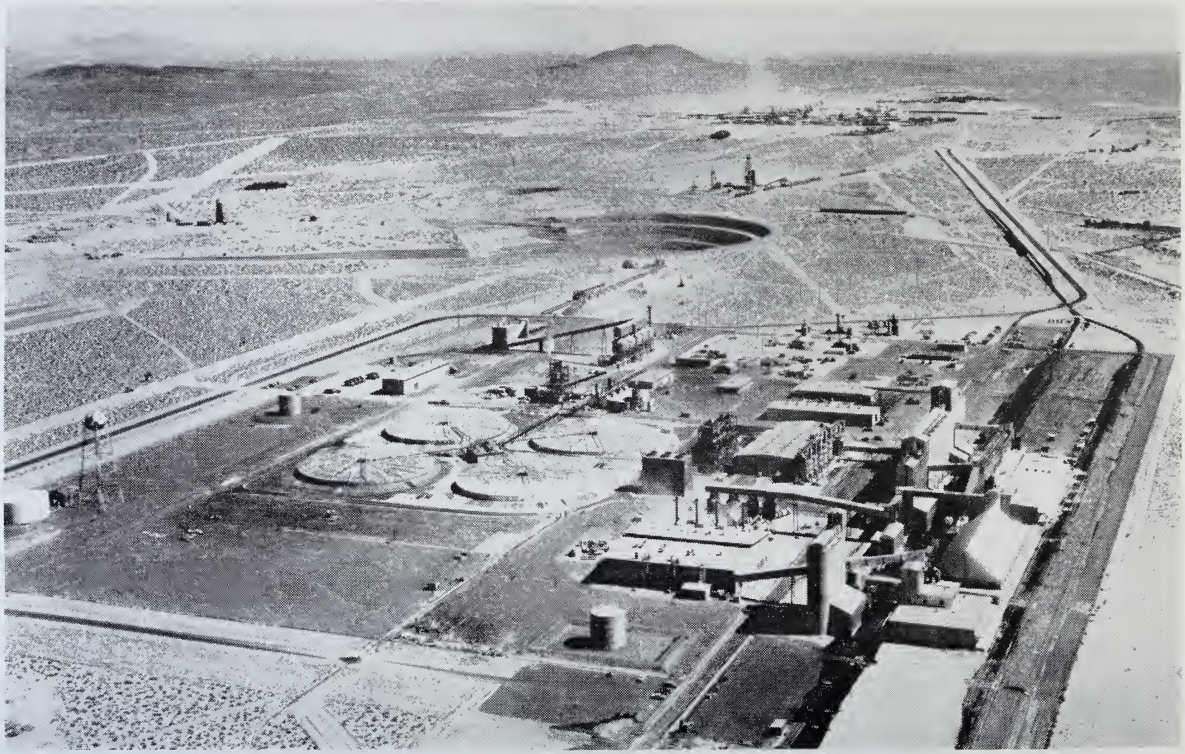

PHOTO 1. United States Borax and Chemical Corporation's huge new $20,000,000 open pit mine and refinery at Boron, in the Mojave Desert 130 miles northeast of Los Angeles. In the background is the company's old plant which eventually will be closed. Near the center of the picture are the four thickener tanks used as settling vessels, with a capacity of more than 3,000,000 gallons each. *Spence Air Photo, courtesy United States Borax and Chemical Corporation.*

Table 6. Annual tonnage and value of crude borate materials produced in California, 1864-1956.

(Tonnage figures for 1902 represent refined borax; from 1922 to 1946 tonnage figures have been recalculated to 40 percent anhydrous boric acid equivalent.)

Year	Short tons	Value	Year	Short tons	Value
1864	12	$9,478	1912	42,135	$1,122,713
1865	126	94,099	1913	58,051	1,491,530
1866	210	132,538	1914	62,500	1,483,500
1867	220	156,137	1915	67,004	1,663,521
1868	32	22,384	1916	103,523	2,409,375
1869			1917	109,944	2,561,958
1870			1918	88,772	1,867,908
1871			1919	66,791	1,717,192
1872	140	89,600	1920	127,065	2,794,206
1873	515	255,440	1921	50,136	1,096,326
1874	915	259,427	1922	39,087	1,068,025
1875	1,168	289,080	1923	62,667	1,893,798
1876	1,437	312,537	1924	52,070	1,599,149
1877	993	193,705	1925	46,124	1,526,938
1878	373	66,257	1926	47,605	1,625,298
1879	364	65,443	1927	72,462	3,043,260
1880	609	149,245	1928	109,722	3,378,552
1881	690	189,750	1929	144,678	3,312,085
1882	732	201,300	1930	209,869	3,686,817
1883	900	265,500	1931	206,405	5,753,037
1884	1,019	198,705	1932	179,356	2,856,470
1885	942	155,430	1933	197,495	3,019,513
1886	1,285	173,475	1934	240,696	5,524,262
1887	1,015	116,689	1935	280,249	4,602,064
1888	1,405	196,636	1936	313,389	5,911,093
1889	965	145,473	1937	326,099	6,206,619
1890	3,201	480,152	1938	276,144	5,014,237
1891	4,267	640,000	1939	244,819	5,110,807
1892	5,525	838,787	1940	212,358	5,254,154
1893	3,955	593,292	1941	224,986	4,745,872
1894	5,770	807,807	1942	203,716	4,929,553
1895	5,959	595,900	1943	216,687	4,953,174
1896	6,754	675,400	1944	234,860	5,264,864
1897	8,000	1,080,000	1945	257,299	5,898,823
1898	8,300	1,153,000	1946	332,157	7,230,925
1899	20,357	1,139,882	1947	501,935	11,844,108
1900	25,837	1,013,251	1948	450,932	11,147,735
1901	22,221	982,380	1949	467,592	11,511,893
1902	17,202	2,234,994	1950	647,735	15,890,000
1903	34,430	661,400	1951	862,797	20,030,000
1904	45,647	698,810	1952	583,826	14,105,000
1905	46,334	1,019,158	1953	715,228	17,668,000
1906	58,173	1,182,410	1954	790,449	26,714,440
1907	53,413	1,200,913	1955	924,496	24,357,723
1908	22,200	1,117,000	1956	944,950	35,721,961
1909	16,628	1,163,960			
1910	16,828	1,177,960	TOTAL	12,894,884	$336,259,934
1911	50,945	1,456,672			

Stripping of the large sodium borate (kernite) lakebed deposit was completed about mid-year in 1957. Benches were carried downward from the level surface at vertical intervals of 50 feet, and by November the pit bottomed at a depth of 175 feet (nearly 50 feet into the borax beds). Open-pit ore production with 3-yard electric power shovels replaced the underground room-and-pillar mining methods and will extend the walls and floor of the pit from their present positions. The new mine and plant represent a $20,000,000 investment by the U. S. Borax and Chemical Corporation and will permit almost 100 percent ore recovery.

Production in 1957 was 597,857 short tons of finished products valued at $40,816,821. The B_2O_3 content was 293,483 short tons. This was the highest annual production on record.

Bromine

California produces about 2 percent of the national output of bromine. In this state bromine is recovered from salt plant bitterns in Alameda County and from the brines of Searles Dry Lake, San Bernardino County.

The bromine production in California during 1956 was the largest in both quantity and value of any year so reported. The 1957 output dropped slightly from that of the previous year.

Most of the bromine was utilized in the manufacture of ethyl gasoline. The remainder was used in the chemical industry in the preparation of grain and soil fumigants.

Cadmium

An undetermined amount of recoverable cadmium is contained in the lead-zinc concentrates from the Darwin and Shoshone mines in Inyo County. Cadmium also occurs in the copper-zinc ores of the Sierra Nevada foothill belt, and in the copper belt of Shasta County.

Calcium Chloride

Since 1910, calcium chloride has been produced from the brines of Bristol Dry Lake, San Bernardino County.

The production of calcium chloride in California during 1956 increased over that of the previous year, and was the largest in both quantity and value of any year on record. The previous peak production year was 1954. Three producing companies operated plants on Bristol Lake near Amboy, San Bernardino County. The processed material was used for road treatment, dust prevention, weed killer, and in the treatment of seaweed in the manufacture of agar. The annual figures are not available.

The production in 1957 dropped 22 percent compared with 1956.

Cement

The production of cement is one of the principal industries of California; the state ranks second in the nation in the output of this commodity.

Crude minerals for cement manufacture are generally plentiful, and are found close to the cement plants, which are located relatively near San Francisco and Los Angeles, the principal marketing centers. Owing to the continued growth in population and the resulting industrial expansion, California is the leading cement-consuming state.

The quantity and value of cement production and shipments in California during 1956 were the highest on record. Cement produced in California totaled 39,547,303 barrels in 1956, of which 16,511,966 barrels came from northern California mills, 23,035,337 barrels from southern California mills. The 1956 output showed a 12 percent increase over that of 1955, which amounted to 35,449,534 barrels, of which 16,142,248 barrels came from northern California mills and 19,307,286 barrels came from southern California mills.

Table 7. Annual quantity and value of cement produced in California, 1891-1946; cement shipments, 1947-57.

Year	Barrels	Value	Year	Barrels	Value
1891	5,000	$15,000	1926	13,797,173	$25,269,678
1892	5,000	15,000	1927	14,661,783	26,474,935
1893	0	0	1928	13,625,231	24,463,287
1894	8,000	21,600	1929	12,794,729	21,038,565
1895	16,383	32,556	1930	9,831,938	14,575,731
1896	9,500	28,250	1931	7,693,712	11,510,655
1897	18,000	66,000	1932	5,657,549	7,967,107
1898	50,000	150,000	1933	7,284,031	10,331,395
1899	60,000	180,000	1934	8,936,085	12,445,616
1900	52,000	121,000	1935	8,086,292	10,210,721
1901	71,800	159,842	1936	13,300,188	18,314,589
1902	171,000	423,600	1937	12,072,062	16,546,229
1903	640,868	968,727	1938	10,561,037	15,502,574
1904	969,538	1,539,807	1939	10,984,033	15,616,219
1905	1,265,553	1,791,916	1940	13,955,255	16,673,202
1906	1,286,000	1,941,250	1941	19,531,608	26,248,694
1907	1,613,563	2,585,577	1942	23,306,578	35,808,841
1908	1,629,615	2,359,692	1943	18,515,085	27,865,466
1909	3,779,205	4,969,437	1944	14,599,752	21,249,520
1910	5,453,193	7,485,715	1945	15,922,772	23,469,027
1911	6,371,369	9,085,625	1946	19,546,336	32,403,081
1912	6,198,634	6,074,661	1947	22,846,458	46,539,749
1913	6,167,806	7,743,024	1948	24,162,926	57,742,226
1914	5,109,218	6,558,148	1949	23,201,982	57,464,213
1915	4,918,275	6,044,950	1950	26,685,004	65,258,675
1916	5,299,507	6,210,293	1951	28,956,470	77,753,697
1917	5,790,734	7,544,282	1952	29,786,245	79,457,745
1918	4,772,921	7,969,909	1953	32,002,317	90,872,741
1919	4,645,289	8,591,990	1954	32,707,374	98,169,729
1920	6,709,160	14,962,945	1955	35,087,213	103,803,894
1921	7,404,221	18,072,120	1956	39,289,586	120,511,049
1922	8,962,135	16,524,056	1957	37,731,340	117,852,259
1923	10,825,405	25,999,203			
1924	11,655,131	23,225,850	TOTAL	732,260,797	$1,544,916,459
1925	13,206,630	25,043,335			

The mills are distributed as follows: northern mills, one each in Calaveras, San Benito, San Mateo, Santa Clara, and Santa Cruz Counties; southern mills, three in San Bernardino County, two in Kern and one each in Los Angeles and Riverside Counties. Cement shipped and used in California during 1956 totaled 39,289,586 barrels, worth $120,511,049. The five northern California mills contributed 16,352,607 barrels worth $48,149,709 and the seven southern California mills supplied 22,936,979 barrels worth $72,361,341. In 1955 shipments of all types of cement totaled 35,087,213 barrels valued at $103,803,894, of which northern California mills supplied 16,033,231 barrels worth $45,266,797, and southern California mills supplied 19,053,982 barrels worth $58,537,097.

The annual capacity of all California cement mills totaled 43,582,000 barrels on December 31, 1956. Capacity of the northern California mills operating 26 kilns totaled 18,400,000 barrels and of the southern California mills operating 48 kilns totaled 25,182,000 barrels. Comparative capacity figures for December 31, 1955, were 36,220,000 barrels for all California mills, 15,900,000 barrels for the northern mills and 20,320,000 barrels for the southern mills.

One new cement mill was completed and another was nearing completion at the close of 1956. They are the California Portland Cement mill at Creal near Mojave, Kern County; and the Permanente Cement

Company mill in Cushenbury Canyon, San Bernardino County, respectively.

During 1957 the northern California mills produced 16,718,068 barrels and shipped 16,618,295 barrels valued at $49,993,254. The southern California mills produced 21,652,809 barrels and shipped 21,092,415 barrels valued at $67,859,005. Total California shipments in 1957 were 37,731,340 barrels valued at $117,852,259, a decline of about 4 percent from 1956.

With the completion of the new Permanente plant in Cushenbury Canyon, annual capacity in the state increased to 50,850,000 barrels.

Table 8. Chromite produced in California counties during 1956 and 1957.

County	1956		1957	
	Short tons	Value	Short tons	Value
Del Norte	2,153	$210,159	3,075	$294,762
Placer	122	11,295	88	8,807
San Luis Obispo	10,169	718,677	16,262	1,174,508
Siskiyou	2,354	215,666	1,859	170,021
Tehama	474	41,343	678	60,164
Trinity	40	3,487		
Other counties	*11,770	*991,329	†12,939	†1,080,228
TOTAL	27,082	$2,191,956	34,901	$2,788,490

* Includes Butte, Fresno, Glenn, Humboldt, Monterey, Napa, San Benito, Santa Barbara, and Stanislaus Counties.

† Includes Alameda, Butte, Colusa, El Dorado, Fresno, Glenn, Humboldt, Mendocino, Monterey, Napa, Plumas, San Benito, Santa Barbara, Shasta, Sonoma, Stanislaus, Trinity, and Tuolumne Counties.

Chromite

Serpentine and peridotite, the host rocks for chromite, are widely distributed throughout the Coast Ranges, the Klamath Mountains, and the foothills of the Sierra Nevada. San Luis Obispo in the southern Coast Ranges was the principal producing county during 1956, followed by Fresno, Butte, Siskiyou, and Del Norte Counties.

All of the chromite produced in California during 1957 was delivered to the General Services Administration of the U. S. Government under the Emergency Procurement Service stockpile program. It was formerly necessary to make chrome deliveries to the stockpile at Grants Pass, Oregon. However, during 1956 this requirement was relaxed and deliveries were made for Government account at the railhead nearest the mine. This change in regulations was of great benefit to most producers in California.

One notable development during recent years has been the increased production from disseminated chromite deposits, so that the annual production of concentrates now exceeds that of lump ore.

The chromite produced in California during 1956 totaled 27,082 short tons worth $2,191,956 and came from 93 properties in 15 counties, compared with the 22,105 short tons worth $1,834,277 that came from 112 properties in 20 counties in 1955.

Chromite production in 1957 totaled 34,901 short tons valued at $2,788,490, an increase of 29 percent over 1956.

Table 9. Annual tonnage and value of chromite produced in California, 1869-1957.

(Tonnage figures 1869-1918, inclusive, represent net tons of 2,000 pounds; 1919-46, recalculated to 45 percent Cr_2O_3.) NOTE: Where necessary in order to conceal output of individual producers, production figures are combined to cover a 2-year period (1932-33).

Year	Short tons	Value	Year	Short tons	Value
1869-83 (Del Norte, Sonoma, Placer, Calaveras Cos.)	19,000	$239,400	1919	4,314	$97,164
			1920	1,770	43,031
			1921	347	6,870
1874-87 (San Luis Obispo County)	26,028	329,924	1922	379	6,334
			1923	84	1,658
1887	3,000	40,000	1924	350	6,700
1888	1,500	20,000	1925	191	3,712
1889	2,000	30,000	1926	393	7,063
1890	3,599	53,985	1927	225	5,063
1891	1,372	20,580	1928	729	15,179
1892	1,500	22,500	1929	327	5,025
1893	3,319	49,785	1930	84	1,905
1894	3,680	39,980	1931	441	6,737
1895	1,740	16,795	1932-33	1,206	16,587
1896	786	7,775	1934	294	3,498
1897	0	0	1935	488	6,111
1898	0	0	1936	221	3,314
1899	0	0	1937	1,918	20,830
1900	140	1,400	1938	982	10,864
1901	130	1,950	1939	3,936	52,673
1902	315	4,725	1940	2,599	32,796
1903	150	2,250	1941	17,307	355,354
1904	123	1,845	1942	45,253	1,741,080
1905	40	600	1943	56,201	2,334,838
1906	317	2,859	1944	27,900	1,190,513
1907	302	6,040	1945	10,858	431,445
1908	350	6,195	1946-50	3,037	68,254
1909	436	5,309	1951	6,302	490,974
1910	749	9,707	1952	14,713	1,269,129
1911	935	14,197	1953	26,512	2,078,461
1912	1,270	11,260	1954	30,661	2,285,250
1913	1,180	12,700	1955	22,105	1,834,277
1914	1,517	9,434	1956	27,082	2,191,956
1915	3,725	38,044	1957	34,901	2,788,490
1916	48,943	717,244			
1917	52,379	1,130,298	TOTAL	598,590	$25,909,413
1918	73,955	3,649,497			

Clay

The production of common clay in California is centered around the metropolitan areas of San Francisco, Sacramento, and Los Angeles. The clay is mined from Recent floodplain and alluvial deposits and from shale of Mesozoic age.

California fire clays are of residual and sedimentary origin. They are mined from deposits of Eocene and Paleocene age which are found along the western foothills of the Sierra Nevada and around the northern part of the Santa Ana Mountains.

The crude clay produced in California during 1956 totaled 2,981,595 short tons valued at $6,137,517. Of this, 763,816 short tons worth $954,771 was used in the manufacture of cement and was not included in state totals; 2,217,779 short tons worth $5,182,746 was consumed by the ceramic industry and other users of clay. These figures compare with 2,728,180 short tons worth $5,740,239 produced in 1957, of which 690,390 short tons worth $1,021,450 was consumed by the cement industry and 2,037,790 short tons worth $4,718,789 was consumed in other industries.

Table 10. Clay (other than that used in cement) produced in California counties during 1956 and 1957.

County	1956		1957	
	Short tons	Value	Short tons	Value
Alameda	50,057	$64,522	38,957	$30,002
Amador	235,830	764,963	143,898	371,990
Inyo	9,894	57,499	8,527	47,000
Kern	49,596	208,016	44,300	268,437
Los Angeles	475,528	593,144	518,657	650,225
Orange	49,210	197,180	47,965	241,046
Riverside	298,275	960,460	292,418	965,203
San Bernardino	41,807	212,885	43,299	225,105
Ventura	164,255	199,192	163,369	196,732
Other counties	*843,327	*1,924,885	†736,400	†1,723,049
TOTAL	2,217,779	$5,182,746	2,037,790	$4,718,789

* Includes Calaveras, Contra Costa, Fresno, Marin, Mono, Placer, Sacramento, San Diego, San Joaquin, San Luis Obispo, Sonoma, Stanislaus, Sutter, Tulare, and Yuba Counties.
† Includes Calaveras, Contra Costa, Fresno, Marin, Mono, Sacramento, San Benito, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Santa Clara, Solano, Sonoma, Stanislaus, Sutter, Tulare, and Yuba Counties.

Of the 1956 clay production, 15,711 short tons, worth $144,191, was kaolin; 14,860 short tons, worth $104,191, was ball clay; 606,192 short tons, worth $1,987,911, was fire clay; 3,618 short tons, worth $70,328, was bentonite; 8,936 short tons, worth $49,458, was fullers earth; and the remainder was classed as miscellaneous clay.

Table 11. Copper produced in California counties during 1956 and 1957.

County	1956		1957*	
	Pounds	Value	Pounds	Value
Calaveras			49,300	$14,839
El Dorado			34,200	10,294
Humboldt			128,100	38,558
Imperial			1,400	422
Inyo	1,255,500	$533,588	1,630,300	490,720
Kern	300	127	100	30
Los Angeles, Shasta, Yuba†			400	120
Madera, San Diego†			18,700	5,629
Mono			6,500	1,957
Plumas			2,900	873
Riverside	2,700	1,148	2,600	782
San Bernardino	92,900	39,482	6,900	2,077
Siskiyou			7,900	2,378
Trinity			‡	‡
Other counties	**366,600	**155,805	††700	††211
TOTAL	1,718,000	$730,150	1,890,000	$568,890

* Mine production of copper in terms of recoverable metal, compiled by the U. S. Bureau of Mines.
** Includes Amador, Calaveras, Del Norte, El Dorado, Humboldt, Madera, Mariposa, Plumas, and Shasta Counties.
† Production of counties combined to avoid revealing output of individual producer.
†† Not distributed by county.
‡ Figures not available.

Table 12. Annual poundage and value of copper produced in California, 1882-1957.

Year	Pounds	Value	Year	Pounds	Value
1882	826,695	$144,672	1921	12,088,053	$1,559,358
1883	1,600,862	265,743	1922	22,883,987	3,090,582
1884	876,166	120,911	1923	28,346,860	4,166,989
1885	469,028	49,248	1924	52,089,349	6,823,704
1886	430,210	43,021	1925	46,968,499	6,669,527
1887	1,600,000	192,000	1926	33,521,544	4,693,014
1888	1,570,021	235,303	1927	27,350,316	3,582,888
1889	151,505	18,180	1928	25,162,304	3,623,360
1890	23,347	3,502	1929	33,809,258	5,941,799
1891	3,397,405	424,675	1930	26,534,752	3,449,522
1892	2,980,944	342,808	1931	12,954,842	1,178,890
1893	239,682	21,571	1932	1,417,536	89,307
1894	738,594	72,486	1933	992,515	63,521
1895	225,650	21,901	1934	590,638	47,252
1896	1,922,844	199,599	1935	2,031,836	168,645
1897	13,638,626	1,540,666	1936	9,991,799	919,245
1898	21,543,229	2,475,168	1937	10,512,500	1,272,013
1899	23,915,486	3,990,534	1938	1,613,491	158,122
1900	29,515,512	4,748,242	1939	8,390,215	872,582
1901	34,931,788	5,501,782	1940	12,833,363	1,450,170
1902	27,860,162	3,239,975	1941	8,101,449	955,970
1903	19,113,861	2,520,997	1942	2,138,149	258,716
1904	29,974,154	3,969,995	1943	17,172,440	2,232,417
1905	16,997,489	2,650,605	1944	25,584,865	3,453,957
1906	28,726,448	5,522,712	1945	13,949,675	1,883,206
1907	32,602,945	6,341,387	1946	8,377,352	1,357,131
1908	40,868,772	5,350,777	1947	4,814,000	1,010,940
1909	65,727,736	8,478,142	1948	962,000	208,754
1910	53,721,032	6,680,641	1949	1,298,000	255,706
1911	36,838,024	4,604,753	1950	1,292,000	268,736
1912	34,169,997	5,638,049	1951	1,842,000	445,764
1913	34,471,118	5,343,023	1952	1,600,000	387,200
1914	30,491,535	4,055,375	1953	764,000	219,268
1915	40,968,966	7,169,567	1954	724,000	213,580
1916	55,809,019	13,729,017	1955	1,226,000	457,298
1917	48,534,611	13,249,948	1956	1,718,000	730,150
1918	47,793,046	11,805,883	1957	1,890,000	568,890
1919	22,162,605	4,122,246			
1920	12,947,299	2,382,303	TOTAL	1,283,914,000	$201,995,580

Coal

Flat-lying, lens-shaped bodies of lignite occur in a series of clay, shale, and sandstone beds comprising the Ione formation of middle Eocene age. The Ione formation is exposed in isolated patches along the western foothills of the Sierra Nevada. Its lignite content is particularly high near Ione, Amador County.

The coal mined in California during 1956 and 1957 came from a single property in Amador County. It was the lignite variety and was not used as a fuel but as a source of montan wax, vandyke brown, and humic acid. The montan wax is used as an insulator in electric cable, in polishes, and as a substitute for carnauba wax in phonograph records, candles, and waterproof paints and varnishes. The vandyke brown was used as a pigment in shoe polishes and the humic acid was used as a soil additive. Annual details of production were not revealed.

Copper

Domestic mine production, smelter output and world mine production of copper established new highs during 1956. The high level of consumption, coupled with inadequate supplies during the early part

of the year, pushed the domestic price of refined copper to its highest level in over 90 years, namely 47½ cents per pound; custom smelters quoted 55 cents per pound. Little benefit from this situation accrued to California mines, however, as California copper production during recent years has been largely a by-product of mining for other metals.

Although very little copper was produced from the mines in the Shasta copper-zinc district, exploration programs were actively pursued. The exploration work included aerial photography, detailed geologic mapping, geophysical surveys, and diamond core-drilling. The installation of a new selective flotation plant was begun at the Copper Bluff mine, Humboldt County, to treat the zinc-copper sulfide ore mined there by Providence Tuolumne Gold Mines, Inc.

The copper produced in California during 1956 totaled 1,718,000 pounds worth $730,150, compared with 1,226,000 pounds worth $457,298 in 1955. Inyo led the counties of the state with its output of copper recovered as a by-product from mining tungsten ores. Amador County ranked second, the ore coming from a copper mine in the Foothill Copper Belt of the Sierra Nevada.

Copper ore sold or treated in California during 1956 totaled 14,866 short tons, averaged 1.78 percent copper, and yielded 529,500 pounds of recoverable copper. This ore also contained a total of 292 ounces of recoverable gold and 10,758 ounces of recoverable silver. The average value of the ore in gold and silver was $1.34 per ton.*

Copper production in 1957 totaled 1,890,000 pounds valued at $568,890.

PHOTO 2. Copper Bluff copper-zinc flotation plant near Hoopa, Humboldt County. View east, showing office, mill building, and ore bins. Mine and mill operated by the Providence Tuolumne Gold Mines, Ltd. *Photo by J. C. O'Brien.*

* Mote, R. H., and others, 1957, Copper industry in 1956: U.S. Bur. Mines, Mineral market report, M.M.S. No. 2682.

Diatomite

Diatomite is a light-colored, light-weight sedimentary rock composed chiefly of the microscopic tests of single-celled, silica-secreting plants called diatoms. California leads all states in the production of diatomite, and Lompoc, Santa Barbara County, is the site of the most extensive diatomite quarries in the world.

The diatomite produced in California during 1956 and 1957 came from properties in Los Angeles, Napa, and Santa Barbara Counties. The 1956 output was the largest in both quantity and value of any year on record. Production increased to a new high in 1957 but price declines permitted the value of production to drop below the peak reached in 1956.

The diatomite was used in filters, fillers, insulation, abrasives, admix in concrete, and in the manufacture of a light-weight concrete aggregate.

Feldspar

The feldspar reported shipped in California during 1956 and 1957 came from single properties in Monterey and San Bernardino Counties. The material from San Bernardino County was crude feldspar mined from a pegmatite dike 9 miles northeast of Fremont Peak.

The feldspar from Monterey County was a flotation concentrate recovered as a by-product in the cleaning of glass sand. Most of the feldspar produced in California is used in the glass and ceramic industries, but some is used in the enamel industry, and as an abrasive in soaps and cleaners.

Fluorspar

During 1956 no fluorspar was reported produced in California. In 1957 a small tonnage of fluorite was mined, milled, and shipped from a property in San Bernardino County.

Garnets

During 1956 and 1957 no abrasive garnets were reported from California sources. In 1955 a small tonnage was reported shipped from Inyo County and was sold for the sand blasting of ships, airplanes, and concrete blocks. The garnets were recovered from tailings of tungsten mills.

Gem Stones

Gem stones are rare natural materials of unusual beauty and durability. They may be classed as precious stones, semi-precious stones, and organic materials. The semi-precious gem stones are quite numerous and generally are relatively rare varieties of common minerals.

The production of semi-precious gem stones in California is somewhat irregular and uncertain. Each year, however, small quantities of semi-precious gem stones are collected or produced by mineral dealers, hobbyists, and amateur lapidarists at widely scattered localities throughout the state.

An estimated value of $90,000 has been placed on specimens reported during 1956 from the localities listed in table 13. During 1957 the estimate was increased to $100,000, as most of the established

Table 13. Semi-precious gems and mineral specimens reported in California during 1956.

County	Mineral
Amador	Rhodonite
Calaveras	Copper specimens
Colusa	Onyx (chalcedony)
Fresno	Petrified wood and chert
Humboldt	Jasper
Imperial	Paisley agate, petrified palm wood, kyanite, garnets, sand spikes, and fossil oyster shells
Inyo	Amethyst, quartz crystals, bloodstone
Kern	Jasper, rhodonite
Lake	Jasper, myrickite, obsidian, cinnabar, and clear quartz crystals (Lake County diamonds)
Marin	Fossil whale bone
Mariposa	Mariposite and ankerite
Mendocino	Jade and jasper
Modoc	Obsidian and petrified wood
Mono	Geodes
Monterey	Jade (nephrite), rhodonite, and limestone
Napa	Onyx (chalcedony), and jasper
Placer	Agate
Riverside	Fire agate, chalcedony, jasper, and geodes
San Benito	Benitoite, jadeite, jasper
San Bernardino	Agate, blue agate, jasper, quartz crystals, opalite, petrified wood, petrified palm, amethyst, moss agate, rhodonite, and chalcedony
San Diego	Spessartite garnet, topaz, tourmaline, smokey quartz
San Luis Obispo	Agate, jade (nephrite)
San Mateo	Jasper
Santa Clara	Jasper
Siskiyou	Jade (nephrite), and californite
Tulare	Quartz crystals and chrysoprase

dealers reported an increase in crude material purchased from prospectors and miners for resale.

Gold

In 1956 California gold production dropped 23 percent below that of the previous year and fell to the lowest point since 1945. The 1956 production totaled 193,816 fine ounces valued at $6,783,560. California, formerly the leading gold producing state, now ranks behind South Dakota, Utah, and the Territory of Alaska in annual production.

Lode mines accounted for 59,369 fine ounces of the 1956 production in California, valued at $2,077,915; placer mines produced 134,447 fine ounces valued at $4,705,645. One hundred and sixteen lode mines in 23 counties and 76 placer mines in 21 counties contributed to the total California production during the year. The latter figures do not include gold recovered by snipers and miscellaneous prospectors.

Gold production continued to decline in 1957, and dropped to the lowest point in 12 years. A total of 170,885 ounces was produced, valued at $5,980,975. Of this quantity, 121,617 fine ounces valued at $4,256,595 came from placer mines (chiefly large bucket-line dredges), and 49,268 fine ounces valued at $1,724,880 was produced by lode mines.

About the middle of the year underground mining was suspended by the Idaho-Maryland Mines Corporation at its Grass Valley, Nevada County, properties. The mines were closed and much of the surface equipment was sold. Profitable operation was no longer possible with the price of gold pegged at $35.00 per ounce.

Table 14. Gold produced in California counties during 1956 and 1957.

County	1956		1957**							
			Mines producing[1]		Gold					
					Lode		Placer		Total	
	Fine oz.	Value	Lode	Placer	Fine oz.	Value	Fine oz.	Value	Fine oz.	Value
Alpine			1							
Amador			[2]	2	[3]	[3]	52	$1,820	[3]52	[3]$1,820
Butte	72	$2,520	[2]	3	[3]	[3]	123	4,305	[3]123	[3]4,305
Calaveras			6	1	77	$2,695	[4]	[4]	[4]77	[4]2,695
El Dorado			4	1	5,778	202,230	[4]	[4]	[4]5,778	[4]202,230
Fresno				[2]			193	6,755	193	6,755
Humboldt			1	1	438	15,330	3	105	441	15,435
Imperial			3		1	35			1	35
Inyo	1,706	59,710	22		693	24,255			693	24,255
Kern	4,533	158,655	11	[2]	701	24,535	[4]	[4]	[4]701	[4]24,535
Los Angeles, Shasta, Yuba‡			4	8	1,473	51,555	81,380	2,848,300	82,853	2,899,855
Madera, San Diego‡			3		53	1,855			53	1,855
Mariposa			6	1	1,055	36,925	[4]	[4]	[4]1,055	[4]36,925
Merced	27	945								
Mono			5		75	2,625			75	2,625
Nevada	22,862	800,170	6	6	3,522	123,270	294	10,290	3,816	133,560
Placer				4			254	8,890	254	8,890
Plumas			3	4	37	1,295	246	8,610	283	9,905
Riverside	3	105	4		7	245			7	245
Sacramento	49,641	1,737,435	1	1	98	3,430	[4]	[4]	[4]98	[4]3,430
San Bernardino	209	7,315	12		31	1,085			31	1,085
Sierra	10,654	372,890	7	11	16,083	562,905	389	13,615	16,472	576,520
Siskiyou	15,510	542,850	8	6	18,952	663,320	472	16,520	19,424	679,840
Trinity			2	6	[3]	[3]	3,478	121,730	[3]3,478	[3]121,730
Tuolumne			7	[2]	36	1,260	[4]	[4]	[4]36	[4]1,260
Other counties	*88,599	*3,100,965	†2		†158	†5,530	†34,733	†1,215,655	†34,891	†1,221,185
TOTAL	193,816	$6,783,560	118	55	49,268	$1,724,380	121,617	$4,256,595	170,885	$5,980,975

* Includes Amador, Calaveras, El Dorado, Fresno, Imperial, Los Angeles, Madera, Mariposa, Mono, Placer, Plumas, San Diego, Shasta, Stanislaus, Trinity, Tuolumne, and Yuba Counties.

** Mine production of gold in terms of recoverable metal; compiled by U. S. Bureau of Mines.

† Not distributed by county; includes output indicated by footnotes ([3]) and ([4]).

†† Combined to avoid disclosing individual output.

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.

[2] From property not classed as a mine.

[3] Lode output withheld to avoid disclosing individual company confidential data; included with "Other counties."

[4] Placer output withheld to avoid disclosing individual confidential data; included with "Other counties."

Table 15. Annual quantity and value of gold produced in California, 1848-1957.

(Figures from 1903-23 prepared by U. S. Geological Survey; 1924-57, by U. S. Bureau of Mines. Values calculated on the following bases: 1848-1932, inclusive, average weighted price of $20.6718 per fine oz.; 1933, average weighted price of $25.56 per fine oz.; 1934, average weighted price of $34.95 per fine oz.; 1935-57, $35.00 per fine oz.)

Year	Fine ounces	Value	Year	Fine ounces	Value
1848	11,866	$245,301	1904	901,484	$18,633,676
1849	491,072	10,151,360	1905	914,217	18,898,545
1850	1,996,586	41,273,106	1906	906,182	18,732,452
1851	3,673,512	75,938,232	1907	809,214	16,727,928
1852	3,932,631	81,294,700	1908	907,590	18,761,559
1853	3,270,803	67,613,487	1909	979,007	20,237,870
1854	3,358,867	69,433,931	1910	953,734	19,715,440
1855	2,684,106	55,485,395	1911	954,870	19,738,908
1856	2,782,018	57,509,411	1912	953,640	19,713,478
1857	2,110,513	43,628,172	1913	987,187	20,406,958
1858	2,253,846	46,591,140	1914	999,113	20,653,496
1859	2,217,829	45,846,599	1915	1,085,646	22,442,296
1860	2,133,104	44,095,163	1916	1,035,745	21,410,741
1861	2,026,187	41,884,995	1917	971,733	20,087,504
1862	1,879,595	38,854,668	1918	799,588	16,528,953
1863	1,136,897	23,501,736	1919	807,667	16,695,955
1864	1,164,455	24,071,423	1920	692,297	14,311,043
1865	867,405	17,930,858	1921	759,721	15,704,822
1866	828,367	17,123,867	1922	709,678	14,670,346
1867	883,591	18,265,452	1923	647,210	13,379,013
1868	849,265	17,555,867	1924	636,140	13,150,175
1869	881,830	18,229,044	1925	632,035	13,065,330
1870	844,537	17,458,133	1926	576,798	11,923,481
1871	845,493	17,477,885	1927	564,586	11,671,018
1872	748,951	15,482,194	1928	521,740	10,785,315
1873	726,554	15,019,210	1929	412,479	8,526,703
1874	835,186	17,264,836	1930	457,200	9,451,162
1875	816,377	16,876,009	1931	523,135	10,814,162
1876	735,169	15,610,723	1932	569,167	11,765,726
1877	798,249	16,501,268	1933	613,579	15,683,075
1878	911,343	18,839,141	1934	719,064	25,131,284
1879	949,439	19,626,654	1935	890,430	31,165,050
1880	968,986	20,030,761	1936	1,077,442	37,710,470
1881	929,920	19,223,155	1937	1,174,578	41,110,230
1882	829,458	17,146,416	1938	1,311,129	45,889,515
1883	1,176,329	24,316,873	1939	1,435,264	50,234,240
1884	657,900	13,600,000	1940	1,455,671	50,948,485
1885	612,478	12,661,044	1941	1,408,793	49,307,755
1886	711,911	14,716,506	1942	847,997	29,679,895
1887	657,349	13,588,614	1943	148,328	5,191,480
1888	616,000	12,750,000	1944	117,373	4,108,055
1889	542,425	11,212,913	1945	147,938	5,177,830
1890	595,486	12,309,793	1946	356,824	12,488,840
1891	615,759	12,728,869	1947	431,415	15,099,525
1892	608,166	12,571,900	1948	421,473	14,751,555
1893	606,664	12,538,780	1949	417,231	14,603,085
1894	670,636	13,863,282	1950	412,118	14,424,130
1895	741,798	15,334,317	1951	339,732	11,890,620
1896	831,158	17,181,562	1952	258,176	9,036,160
1897	767,779	15,871,401	1953	234,591	8,210,685
1898	769,476	15,906,478	1954	237,886	8,326,010
1899	741,881	15,336,031	1955	251,737	8,810,795
1900	767,390	15,863,355	1956	193,816	6,783,560
1901	821,845	16,989,044	1957	170,885	5,980,975
1902	818,037	15,910,320			
1903	788,544	16,300,653	TOTAL	105,235,291	$2,384,979,386

At the same time in 1957 the Empire-Star Mines in Grass Valley were permanently closed, as the company was unable to resolve the labor strike which had been in effect for about a year. High-grade lode gold mines in El Dorado, Sierra, and Siskiyou Counties continued to

PHOTO 3. Cassidy adit portal and mine buildings at the Brush Creek gold mine, Sierra County; view south. *Photo by W. B. Clark.*

operate. Although reduced in number, large bucket-line dredges produced gold from the placers of Sacramento, Trinity, and Yuba Counties.

Granite

See *Stone.*

Gypsum

California supplied 14 percent of the national output of crude gypsum in 1956 and production in the state increased to new record high

Table 16. Gypsum produced in California counties during 1956 and 1957.

County	1956		1957	
	Short tons	Value	Short tons	Value
Kern	426,608	$769,264	472,953	$814,805
Other counties*	972,782	2,632,342	795,068	2,180,301
TOTAL	1,399,390	$3,401,606	1,268,021	$2,995,106

* Includes Imperial, Kings, Merced, Riverside, San Luis Obispo, and Ventura Counties.

Table 17. Annual tonnage and value of gypsum produced in California, 1887-1957.

Year	Short tons	Value	Year	Short tons	Value
1887	2,700	$27,000	1924	25,569	$53,210
1888	2,500	25,000	1925	107,613	172,444
1889	3,000	30,000	1926	114,868	211,337
1890	3,000	30,000	1927	94,630	292,090
1891	2,000	20,000	1928	104,790	200,567
1892	2,000	20,000	1929	140,844	396,951
1893	1,620	14,280	1930	116,865	243,507
1894	2,446	24,584	1931	88,354	199,198
1895	5,158	51,014	1932	46,867	93,818
1896	1,310	12,580	1933	59,235	120,451
1897	2,200	19,250	1934	58,149	113,606
1898	3,100	23,600	1935	70,833	151,807
1899	3,663	14,950	1936	143,549	282,703
1900	2,522	10,088	1937	186,160	384,431
1901	3,875	38,750	1938	161,996	327,821
1902	10,200	53,500	1939	219,672	437,343
1903	6,914	46,441	1940	314,843	599,944
1904	8,350	56,592	1941	432,784	854,184
1905	12,859	54,500	1942	425,268	791,892
1906	21,000	69,000	1943	475,967	916,883
1907	8,900	57,700	1944	558,488	949,833
1908	34,600	155,400	1945	442,133	954,696
1909	30,700	138,176	1946	618,007	1,431,884
1910	45,294	129,152	1947	811,798	1,996,157
1911	31,457	101,475	1948	962,038	2,354,390
1912	37,529	117,388	1949	753,581	1,852,452
1913	47,100	135,050	1950	962,373	2,462,604
1914	29,734	78,375	1951	1,092,883	2,602,758
1915	20,200	48,953	1952	1,236,430	2,721,134
1916	33,384	59,533	1953	1,199,489	2,855,983
1917	30,825	56,840	1954	1,161,502	2,803,862
1918	19,695	37,176	1955	1,307,625	3,273,724
1919	19,813	50,579	1956	1,399,390	3,401,606
1920	20,507	92,535	1957	1,268,021	2,995,106
1921	37,412	78,875			
1922	47,084	188,336	TOTAL	17,844,705	$41,956,184
1923	86,410	289,136			

points during the year. The gypsum production in California during 1956 totaled 1,399,390 short tons worth $3,401,606 and came from 12 properties in six counties. A total of 705,942 short tons of gypsum was sold in the state as a soil conditioner in 1956. Production in 1957 was 1,268,021 short tons, valued at $2,995,106.

Iodine

Iodine is recovered annually from water coming from oil wells in the Dominguez, Seal Beach, Venice, and Signal Hills oil fields by two plants in Los Angeles County. Part of the water coming from wells in Seal Beach field is credited to Orange County. The rest of the wells are in Los Angeles County.

Iron Ore

The iron ore mined and shipped in California in 1956 totaled 2,414,277 long tons, compared with 1,776,536 long tons in 1955. The 1956 iron ore output was the largest in both quantity and value of any year on record, and came from one property in Riverside County and two properties in San Bernardino County. The ore mined in Riverside County and part of that from San Bernardino County was shipped to the Kaiser steel mills at Fontana. The remainder of the ore mined in

San Bernardino County was shipped to cement mills to be used in the manufacture of certain cements.

Production in 1957 showed an increase over the preceding year and was at an all-time high.

A second ore beneficiation plant was completed and placed "on stream" at the Eagle Mountain mine in 1957. Ore from various mines in San Bernardino County also was shipped to the Kaiser steel plant at Fontana, where a huge expansion program was initiated. A fourth blast furnace is being added to the plant, as well as other facilities which will increase steel-producing capacity by 40 percent.

Lead

Recoverable lead shipped to smelters from California mines totaled 18,592,000 pounds in 1956, and was worth $2,918,944. Most of the lead mined in 1955 and 1956 came from the mines at Darwin and Shoshone, Inyo County.

Falling prices for lead (from 16 cents in January to 13½ cents in June, per pound) and zinc (from 13½ cents in January to 10¼ cents in June, per pound) forced closing of these mines about mid-year in 1957. The 1957 lead production totaled 6,916,000 pounds, valued at $988,988.

Lime

The 1956 lime output was the largest in quantity and value of any year on record; it totaled 302,479 short tons worth $5,077,951, as compared with the 268,009 short tons, worth $4,372,789, produced in 1955.

The lime manufactured during 1956 came from kilns of two companies in San Bernardino County and one company each in El Dorado, Monterey, and Tuolumne Counties. Most of California's lime is used in refractories or by the chemical and metallurgical industries. Only a small percentage is used in the building industry and a very small percentage in agriculture.

The output of lime in California increased again in 1957 to a total of 325,309 short tons valued at $5,407,588. The use of chemical and industrial lime increased during the year, while lime used in refractories and in the building trades declined.

Table 18. Lead produced in California counties during 1956 and 1957.

County	1956		1957*	
	Pounds	Value	Pounds	Value
Calaveras			200	$29
El Dorado			35,600	5,091
Humboldt			3,600	515
Imperial			3,300	472
Inyo	18,523,400	$2,908,174	6,829,500	976,618
Kern	500	79		
Mono			12,800	1,830
San Bernardino	34,500	5,416	31,000	4,433
Other counties	†33,600	†5,275		
TOTAL	18,592,000	$2,918,944	6,916,000	$988,988

* Mine production of lead in terms of recoverable metal; compiled by the U. S. Bureau of Mines.
† Includes Amador, El Dorado, and Shasta Counties.

Table 19. Annual poundage and value of lead produced in California, 1877-1957.

(Poundage figures, 1877-81, inclusive, after C. E. Siebenthal, Mineral Resources U. S., 1912, pt. 1, p. 339; value figures, 1877-81, from quotations in Engineering and Mining Journal; poundage, 1882, estimated; poundage and value figures, 1883-86 inclusive, from Mineral Resources U. S.; figures from 1887 to 1946 compiled by State Division of Mines; 1947 to date U. S. Bureau of Mines.

Year	Pounds	Value	Year	Pounds	Value
1877	7,836,000	$391,800	1919	4,139,562	$219,397
1878	8,640,000	328,320	1920	4,903,738	392,300
1879	4,502,000	191,335	1921	1,149,051	51,707
1880	4,200,000	215,460	1922	6,511,280	358,120
1881	6,680,000	325,316	1923	9,934,522	695,416
1882	4,000,000	196,800	1924	4,984,387	398,751
1883	3,400,000	145,520	1925	7,352,422	639,661
1884	3,200,000	120,512	1926	8,067,873	645,429
1885	2,000,000	80,900	1927	2,748,440	173,151
1886	2,000,000	93,400	1928	1,882,795	109,102
1887	1,160,000	52,200	1929	1,428,777	90,014
1888	900,000	38,250	1930	3,542,796	176,241
1889	840,000	35,720	1931	3,934,240	245,568
1890	800,000	36,000	1932	2,418,626	72,480
1891	1,140,000	49,020	1933	772,463	28,583
1892	1,360,000	54,400	1934	804,911	29,655
1893	666,000	24,975	1935	1,142,405	45,695
1894	950,000	28,500	1936	1,098,545	50,533
1895	1,592,400	49,364	1937	2,402,110	141,724
1896	1,293,500	38,805	1938	1,003,096	46,142
1897	596,000	20,264	1939	1,061,294	49,880
1898	655,000	23,907	1940	3,092,636	154,632
1899	721,000	30,642	1941	6,900,851	393,348
1900	1,040,000	41,600	1942	10,329,176	692,054
1901	720,500	28,820	1943	11,811,034	885,827
1902	349,440	12,230	1944	11,408,381	912,670
1903	110,000	3,960	1945	14,504,767	1,247,410
1904	124,000	5,270	1946	20,432,630	2,227,157
1905	533,680	25,083	1947	20,160,000	2,903,040
1906	338,718	19,307	1948	18,220,000	3,261,380
1907	328,681	16,690	1949	20,636,000	3,260,488
1908	1,124,483	46,663	1950	31,662,000	4,274,370
1909	2,685,477	144,897	1951	27,934,000	4,832,582
1910	3,016,902	134,082	1952	22,398,000	3,606,078
1911	1,403,839	63,173	1953	17,328,000	2,269,968
1912	1,370,067	61,653	1954	5,342,000	731,854
1913	3,640,951	160,202	1955	16,530,000	2,462,970
1914	4,697,400	183,198	1956	18,592,000	2,918,944
1915	4,796,299	225,426	1957	6,916,000	988,988
1916	12,392,031	855,049			
1917	21,651,352	1,862,016	TOTAL	488,501,397	$50,100,044
1918	13,464,869	956,006			

Limestone

Industrial limestone includes stone used in fluxing, in refractories, as filler, in the sugar industry, in paint, in asphalt, in agriculture, on poultry farms, in glass-making, in the chemical industry, in whiting, and in the building industry (roofing granules, stucco, terrazzo chips, etc.) and in many other industries.

Production in 1956 originated at quarries in El Dorado, Monterey, Riverside, San Benito, San Bernardino, San Luis Obispo, San Mateo, Santa Clara, Santa Cruz, Shasta, Tuolumne, and Ventura Counties. The material from Ventura County and part of that from San Mateo and Santa Clara County was shells. The dolomite from San Benito County and some of that from Monterey, San Bernardino and Tuolumne Counties is included in the figures on stone.

*Table 20. Annual tonnage and value of lime produced in California, 1894-1957.**

Year	Short tons	Value	Year	Short tons	Value
1894	37,350	$318,700	1927	60,498	$631,497
1895	39,776	386,094	1928	56,616	547,919
1896	30,275	261,505	1929	42,834	417,101
1897	28,780	252,900	1930	47,662	452,084
1898	29,786	254,010	1931	36,189	360,523
1899	29,985	314,575	1932	27,510	254,223
1900	31,252	283,699	1933	33,425	271,619
1901	31,738	334,688	1934	32,500	309,765
1902	44,866	369,616	1935	59,731	573,212
1903	49,659	418,280	1936	64,275	633,678
1904	57,945	571,749	1937	69,532	681,277
1905	61,700	555,322	1938	70,578	683,403
1906	68,927	763,060	1939	87,288	849,122
1907	68,422	756,376	1940	101,395	902,322
1908	36,639	379,243	1941	110,719	996,514
1909	52,075	577,824	1942	98,548	961,803
1910	47,951	477,683	1943	86,332	922,800
1911	42,959	390,988	1944	82,247	883,009
1912	52,212	464,440	1945	91,825	997,236
1913	61,344	528,547	1946	103,628	1,040,592
1914	43,996	378,663	1947	181,296	2,615,599
1915	35,653	286,304	1948	179,257	3,026,941
1916	49,364	390,475	1949	153,483	2,516,262
1917	50,073	311,380	1950	171,440	2,722,835
1918	43,684	461,315	1951	203,344	3,366,959
1919	42,070	552,043	1952	238,957	3,752,738
1920	46,314	557,232	1953	301,422	4,653,303
1921	46,353	610,619	1954	212,381	3,387,981
1922	57,875	671,747	1955	268,009	4,372,789
1923	70,894	788,834	1956	302,479	4,077,951
1924	62,029	703,355	1957	325,309	5,407,588
1925	61,922	685,528			
1926	63,568	670,837	TOTAL	5,481,145	$69,018,276

* Figures from 1894 to 1946 by California Division of Mines; 1947 to 1957, by U. S. Bureau of Mines.

In addition, 1,259,540 short tons of limestone valued at $17,354,910 was used in the manufacture of lime and cement during 1956.

Substantial quantities of crushed limestone were used also in road building, as drain rock, as fill material, and for other related purposes. The quantity and value of this material is also included in the figures for stone.

In 1957, 11,860,832 short tons of limestone valued at $16,489,192 was used in the manufacture of lime and cement.

Lithium Salts

Since 1938 lithium salts have been produced from the brines of Searles Lake in San Bernardino County. The crude material recovered from these brines was a sodium lithium phosphate. Lithium minerals (chiefly lepidolite with some amblygonite) were mined from the pegmatite dikes in the Pala district, San Diego County, from 1899 to 1929.

Magnesite

During 1956 a small tonnage of crude magnesite was mined from the Western mine on Red Mountain, Santa Clara County, and shipped to a chemical company in Alameda County. No production was reported in 1957.

Table 21. Quantity and value of limestone used in various industries.

Year	Cement		Aggregate etc.		Sugar refineries	
	Tons	Value	Tons	Value	Tons	Value
1957	11,165,200	$14,685,783	1,066,563	$1,112,229	*	*
1956	11,583,084	16,119,212	971,047	1,025,277	153,206	465,321
1955	10,462,734	15,514,339	724,238	827,107	146,506	533,245
1954	9,150,155	16,017,315	799,816	876,453	162,218	577,988
1953	8,932,829	[1]	821,545	869,280	133,664	455,318
1952	8,358,055	[1]				
1951						
1950						

Year	Metallurgical flux		Roofing granules etc.		Agriculture	
	Tons	Value	Tons	Value	Tons	Value
1957	298,294	$898,458	69,817	$694,815	78,259	$668,345
1956	52,240	171,561	37,083	381,626	96,508	607,638
1955	61,501	223,682	60,096	425,055	84,504	561,619
1954	238,787	736,293	41,802	484,946	81,185	515,307
1953	63,021	185,092	24,951	253,024	69,766	479,311
1952						
1951						
1950						

Year	Dimension stone		Lime		Miscellaneous	
	Tons	Value	Tons	Value	Tons	Value
1957	852	$5,494	695,632	$1,803,407	674,539	$1,863,496
1956	1,957	7,832	676,456	1,235,698	443,579	1,150,923
1955	4,502	98,230	514,818	917,095	286,893	992,941
1954	5,335	105,726	417,036	1,212,232	373,282	1,277,102
1953			477,914		601,064	2,089,196
1952						
1951						
1950						

Year	Whiting		Total limestone used, less cement and lime		Total	
	Tons	Value	Tons	Value	Tons	Value
1957	52,256	$619,288	2,240,580	$5,862,125	14,101,412	$22,351,315
1956	97,954	945,185	1,853,574	4,755,363	14,113,114	22,110,273
1955	100,998	863,124	1,469,238	4,525,003	12,446,790	20,956,437
1954	21,888	283,435	1,724,313	4,857,250	11,291,504	22,086,797
1953	25,306	367,631	1,739,317	4,698,551		
1952			1,628,462	4,160,209		
1951			1,167,434	3,614,491		
1950			1,065,439	2,899,767		

* Included with Miscellaneous.
[1] From captive quarries; figures not reported by operators.

Magnesium Salts

Magnesium salts, reduced from sea water and salt works bittern at plants on San Francisco Bay, Monterey Bay, and San Diego Bay, were recovered in 1956. They totaled 66,007 short tons MgO equivalent, worth $4,531,777.

The plant in Alameda County on San Francisco Bay and the one on Monterey Bay produced a caustic magnesia compound and a dead burned magnesia compound; the former compound was sold to the plastic and insulation trade; the latter was used in refractories for metallurgical plants. The plant in San Mateo County produced magnesium salts used in the drug and rubber trades; the plant in San Diego County produced magnesium chloride crystals.

In 1957 production totaled 74,558 short tons valued at $5,314,882.

Manganese Ore

Manganese ore with 35 percent or greater Mn content shipped from California mines in 1956 totaled 6,888 short tons, worth $614,631. The 1956 output came from 19 properties in seven counties.

Table 22. Manganese ore and concentrates produced in California counties during 1956.

County	Short tons	Value
Riverside	4,757	$433,913
Trinity	507	44,722
Other counties*	1,624	135,995
TOTAL	6,888	$614,630

* Includes Lake, Mendocino, Plumas, San Bernardino, and San Luis Obispo Counties.

Production from the California manganese mines increased in 1957 and was channeled into the U. S. Government stockpile. High-grade ore was produced chiefly from mines in Riverside County; smaller quantities come from mines in Plumas, Imperial, San Bernardino, Inyo, and San Luis Obispo Counties.

Concentrates were produced chiefly from ore mined in Imperial County. A relatively smaller quantity was produced from ore mined in Riverside County. The production of high-grade ore and concentrates totaled 9,009 short tons, valued at $802,310.

Low-grade ore (less than 35 percent Mn) and concentrates seeking other markets were produced totaling 155 short tons, valued at $5,814. This ore was produced in Lake and San Bernardino Counties.

By the end of 1957 the U. S. Government had purchased 16,718,218 long ton units of recoverable manganese under its carlot program for ore from domestic mines. The allotment under this program remained at 28,000,000 long ton units of manganese.

Marl

During 1956 and 1957 no marl was reported produced in California. The marl mined in 1955 came from a single property in Fresno County and was sold as a soil-conditioning mineral.

Table 23. Annual tonnage and value of manganese produced in California, 1887-1957.

(Tonnage figures used in this table represent net tons of 2,000 pounds.) NOTE: Where necessary in order to conceal output of individual producers, production figures combined to cover a 2-year period (1928-29, etc.).

Year	Tons	Value	Year	Tons	Value
1887	1,000	$9,000	1920	2,892	$62,323
1888	1,500	13,500	1921	1,005	12,210
1889	53	901	1922	540	7,650
1890	386	3,176	1923	690	10,620
1891	705	3,830	1924	1,115	25,785
1892	300	3,000	1925	832	19,450
1893	270	4,050	1926	235	4,700
1894	523	5,512	1927	0	0
1895	880	8,200	1928-29	733	8,216
1896	518	3,415	1930-31	207	2,576
1897	504	4,080	1932-33	0	0
1898	440	2,102	1934-35	432	4,630
1899	295	3,165	1936-38	0	0
1900	131	1,310	1939	6	45
1901	425	4,405	1940	314	3,206
1902	870	7,140	1941	3,565	75,057
1903	1	25	1942	17,362	505,190
1904	60	900	1943	25,729	957,317
1905	0	0	1944	30,263	1,098,555
1906	1	30	1945	1,875	86,270
1907	1	25	1946-48	0	0
1908	321	5,785	1949	666	*$15,384
1909	3	75	1950	677	
1910	265	4,235	1951	0	0
1911	2	40	1952	*27,204	*$1,265,216
1912	22	400	1953		
1913	0	0	1954	37,651	1,543,267
1914	150	1,500	1955	27,775	1,201,807
1915	4,013	49,098	1956	6,888	614,631
1916	13,404	274,601	1957	9,165	808,124
1917	15,515	396,659			
1918	26,075	979,235	TOTAL	278,023	$10,573,045
1919	11,569	451,422			

* Combined to conceal output of individual producers.

Table 24. Mercury produced in California counties during 1956.

County	1956	
	Flasks (76 lbs.)	Value
Fresno	26	$6,758
Lake	2,482	645,121
Napa	105	27,292
San Benito	2,914	757,407
San Luis Obispo	117	30,411
Santa Clara	1,905	495,148
Other counties	*1,468	*381,562
TOTAL	9,017	$2,343,699

* Includes Del Norte, Kings, Marin, Merced, Monterey, San Mateo, Santa Barbara, Sonoma, Stanislaus, and Trinity Counties.

Mercury (Quicksilver)

As in the past, California led the nation in the output of mercury. During 1956 mercury was produced from 48 mines in 16 counties; it totaled 9,017 flasks of 76 pounds, worth $2,343,699. Production was off about 9 percent from 1955.

At the Mount Jackson mine in Sonoma County production was suspended in favor of an exploration program in the later part of the year. A number of California mines were granted exploration contracts under the U. S. Government DMEA program, namely: Abbott, Lake County; Harrison, Napa and Yolo Counties; Buena Vista, San Luis Obispo County; Mount Jackson, Sonoma County; and Toyon, Napa County.

PHOTO 4. Furnace plant for roasting cinnabar at Falcon mercury mine, in Santa Ynez River Valley 2 miles west of Gibraltar Dam, Santa Barbara County. Photo shows rotary kiln, vertical condensers, and mine ore trestle; tracks in foreground lead to calcine dump.

In 1957 California mercury production was the highest since 1947. Although the quoted price for mercury (New York) dropped from $255 per flask in July to $230 in November 1957, the value of the mine output increased to the highest point since 1943. In 1957 California production totaled 16,511 flasks, valued at $4,077,887—up 83 percent in quantity and 74 percent in value over the previous year.

The large mines reaped the benefits of earlier exploration work in increased production and some new small mines were added to the production list. At New Idria, San Benito County, nearly all recent production has come from the new "West Idria" section of the mine. Here, new ore has been found in the Franciscan sandstone on the west side of the thrust fault, an area previously considered barren.

Exploitation and development continued on the 600-foot level at the Altoona mine in Trinity County and in November 1957 the mine was optioned to Rare Metals Corporation of America.

Table 25. Annual quantity and value of mercury produced in California, 1850-1957.

(Flasks as tabulated herein, contained 76½ lbs. from 1850 to May 1904, inclusive; 75 lbs. from June 1904 to 1927, inclusive; 76 lbs. from 1928 to date. Sources of information used in preparing this table are: 1850-83, a table by J. B. Randol published in Report 4 of the State Mineralogist, p. 336; 1883-93, reports of the U. S. Geological Survey; 1894 to 1946 compiled by State Division of Mines; 1947 to 1957, compiled by U. S. Bureau of Mines cooperating with State Division of Mines.)

Year	Flasks	Value	Average price per flask	Year	Flasks	Value	Average price per flask
1850	7,723	$768,052	$99 45	1905	24,655	$886,081	$35 94
1851	27,779	1,859,248	66 93	1906	19,516	712,334	36 50
1852	20,000	1,166,600	58 33	1907	17,379	663,178	38 16
1853	22,284	1,235,648	55 45	1908	18,039	763,520	42 33
1854	30,004	1,663,722	55 45	1909	16,217	773,788	47 71
1855	33,000	1,767,150	53 55	1910	17,665	799,002	45 23
1856	30,000	1,549,500	51 65	1911	19,109	879,205	46 01
1857	28,204	1,374,381	48 73	1912	20,600	866,024	42 04
1858	31,000	1,482,730	47 83	1913	15,661	630,042	40 23
1859	13,000	820,690	63 13	1914	11,373	557,846	49 05
1860	10,000	535,500	53 55	1915	14,199	1,157,449	81 52
1861	35,000	1,471,750	42 05	1916	21,427	2,003,425	93 50
1862	42,000	1,526,700	36 35	1917	24,382	2,396,466	98 29
1863	40,531	1,705,544	42 08	1918	22,621	2,579,472	114 03
1864	47,489	2,179,745	45 90	1919	15,200	1,353,381	89 04
1865	53,000	2,432,700	45 90	1920	10,278	775,527	75 45
1866	46,550	2,473,202	53 13	1921	3,157	140,666	44 56
1867	47,000	2,157,300	45 90	1922	3,466	191,851	55 35
1868	47,728	2,190,715	45 90	1923	5,458	332,851	60 98
1869	33,811	1,551,925	45 90	1924	7,948	543,080	68 33
1870	30,077	1,725,818	57 38	1925	7,683	621,831	80 81
1871	31,686	1,999,387	63 10	1926	5,892	516,382	87 64
1872	31,621	2,084,773	65 93	1927	6,488	714,418	111 67
1873	27,642	2,220,482	80 33	1928	7,107	844,649	118 84
1874	27,756	2,919,376	105 18	1929	10,152	1,195,705	117 78
1875	50,250	4,228,538	84 15	1930	11,374	1,255,257	110 36
1876	75,074	3,303,256	44 00	1931	13,478	1,121,624	83 22
1877	79,396	2,961,471	37 30	1932	5,349	279,780	52 30
1878	63,880	2,101,652	32 90	1933	4,102	229,472	55 94
1879	73,684	2,194,674	29 85	1934	7,946	534,135	67 22
1880	59,926	1,857,706	31 00	1935	9,353	628,590	67 23
1881	60,851	1,815,185	29 83	1936	8,758	671,055	76 62
1882	52,732	1,488,624	28 23	1937	9,995	837,789	83 82
1883	46,725	1,343,344	28 75	1938	12,171	846,497	69 55
1884	31,913	973,347	30 50	1939	11,201	1,105,563	98 43
1885	32,073	986,245	30 75	1940	18,907	3,209,754	169 77
1886	29,981	1,064,326	35 50	1941	25,612	4,509,041	176 03
1887	33,760	1,430,749	42 38	1942	30,087	5,553,357	184 58
1888	33,250	1,413,125	42 50	1943	33,948	6,177,159	181 96
1889	26,464	1,190,880	45 00	1944	28,097	3,178,969	113 14
1890	22,926	1,203,615	52 50	1945	21,063	2,697,835	128 08
1891	22,904	1,036,406	45 25	1946	17,804	1,648,758	92 61
1892	27,993	1,139,595	40 71	1947	17,165	1,437,397	83 74(NY)
1893	30,164	1,108,527	36 75	1948	11,188	855,770	76 49(NY)
1894	30,416	934,000	30 70	1949	4,493	357,014	79 46(NY)
1895	36,104	1,337,131	37 04	1950	3,850	313,000	81 26(NY)
1896	30,765	1,075,449	34 96	1951	4,282	899,777	210 13(NY)
1897	26,691	993,445	37 28	1952	7,241	1,441,683	199 10(NY)
1898	31,092	1,188,626	38 23	1953	9,290	1,793,249	193 03(NY)
1899	29,454	1,405,045	47 70	1954	11,262	2,977,560	264 39(NY)
1900	26,317	1,182,786	44 94	1955	9,875	2,867,206	290 35(NY)
1901	26,720	1,285,014	48 46	1956	9,017	2,343,699	259 92(NY)
1902	29,552	1,276,524	43 20	1957	16,511	4,077,887	246 98(NY)
1903	32,094	1,335,954	42 25				
1904	28,876	1,086,323	37 62	TOTAL	2,696,003	$165,551,250	

The U. S. Government purchase program for domestic mercury at a guaranteed price of $225 per flask was extended through 1958 with funds earmarked for the purchase of 30,000 flasks. The Defense Min-

erals Exploration Administration program was continued but U. S. Government participation was lowered from 75 to 50 percent of approved costs.

Mica

The mica mined in California during 1956 and 1957 came from two properties near Ogilby, Imperial County. The material was all sericite schist and was ground and sold to manufacturers of roofing paper.

Mineral Pigments

Mineral pigments manufactured in California during 1956 and 1957 came from plants in Alameda and Amador Counties. The plant in Alameda County produced iron oxide pigments and the plant in Amador County produced a vandyke brown from coal (lignite).

Mineral Water

Water from springs and artesian wells, bottled and in part artificially carbonated, is classed as mineral water. Health and pleasure resorts are located at many hot springs in California. The water at some of the hot springs is not suitable for drinking but is utilized for bathing. Counties from which mineral waters are bottled and sold are Butte, Calaveras, Lake, Los Angeles, Marin, Napa, Orange, Riverside, San Benito, San Bernardino, San Diego, San Francisco, San Luis Obispo, Santa Barbara, Shasta, Siskiyou, Sonoma, and Tehama. No canvass of mineral water producers is made by the U. S. Bureau of Mines.

Molybdenum

Molybdenum concentrates were produced in California as a by-product of tungsten mining. The 1956 and 1957 output came from the Pine Creek mine of the Union Carbide Nuclear Co. near Bishop, Inyo County. Here, the known ore bodies in the contact metamorphic deposit contain molybdenite associated with scheelite. The average grade of the ore milled is about 0.4 percent MoS_2.

The quantity and value of molybdenum concentrates produced in 1957 were the highest of any year thus far reported from California deposits.

Natural Gas

The natural gas produced and used in California during 1956 totaled 504,458,000 M cubic feet, worth $113,503,000, and came from wells in 26 counties. Both figures showed a decrease from those reported in 1955. California ranks fourth in quantity and third in value among the states in natural gas output. In 1957, California production was 502,572,000 M cubic feet, valued at $114,416,000.

Natural gas production in California declined 6 percent in 1957. In order to meet statewide demand for this commodity, natural gas imports increased 15 percent during the year and amounted to nearly 642,000,000 M cubic feet. The imported gas originated in fields in the southwestern part of the United States (New Mexico and west Texas), and was transported to the local market via pipelines.

Table 26. Natural gas produced in California counties during 1956.

County	1956	
	M cu. ft.	Value
Butte	5,677,000	$1,419,000
Fresno	34,243,000	7,396,000
Glenn	6,077,000	1,519,000
Kern	78,148,000	16,880,000
Kings	11,247,000	2,429,000
Los Angeles	95,409,000	20,608,000
Madera	3,190,000	798,000
Orange	26,989,000	5,830,000
Sacramento	49,511,000	12,378,000
San Joaquin	15,588,000	3,897,000
Santa Barbara	18,757,000	4,052,000
Solano	35,467,000	8,867,000
Tulare	6,449,000	1,612,000
Ventura	80,348,000	17,355,000
Yolo	2,474,000	618,000
Other counties	*34,884,000	*7,845,000
TOTAL	504,458,000	$113,503,000

* Includes Colusa, Contra Costa, Humboldt, Monterey, San Benito, San Bernardino, San Luis Obispo, San Mateo, Sonoma, Sutter, and Tehama Counties.

Natural Gas Liquids

Natural gas gasoline and cycle products recovered in California during 1956 totaled 876,902,000 gallons, valued at $84,615,000; this was a decline in both quantity and value from 1955. The 1957 production was 843,378,000 gallons, valued at $81,355,000.

Liquefied petroleum gases reported in 1956 in California totaled 410,232,000 gallons, valued at $21,332,000—a marked increase over the 1955 output. The 1957 production was 390,743,000 gallons, valued at $20,421,000.

Peat

Peat deposits are widespread in California, but only in four areas are the deposits known to be of suitable quality, large enough, and so located to be of present commercial value. These areas, from which substantial amounts of peat have been mined and then processed, are the Sacramento-San Joaquin delta area, Orange County, Modoc County, and Santa Cruz County.

In the United States peat is used mostly as a soil conditioner and in mixed fertilizers. Very small amounts are used as mull or litter material for domestic animals, as packing material, and in chemical applications such as filtering and tanning.

The peat produced in California during 1956 and 1957 came from properties in Contra Costa, Modoc, and Orange Counties. All was sold as soil conditioner. The peat from Contra Costa County was reed or sedge peat, that from Modoc County was peat moss, and that from Orange County was humus.

The peat harvest in California during 1956 totaled 18,918 short tons valued at $214,738, and came from two properties each in Contra Costa and Orange Counties, and one property in Modoc County.

Table 27. Annual volume and value of natural gas produced in California, 1888-1957.

NOTE: From 1888-98 and 1911-12, inclusive, some operators reported values only; volume (M cu. ft.) estimated from values. Statistical bulletins issued prior to 1933 included carbon-dioxide production (1894-96 exclusive) with natural-gas figures; in later bulletins carbon dioxide is included under industrial materials.

Year	M cubic feet	Value	Year	M cubic feet	Value
1888	12,000	$10,000	1924	209,021,596	$15,153,140
1889	14,500	12,680	1925	194,719,924	15,890,082
1890	41,250	33,000	1926	214,549,477	19,465,347
1891	39,000	30,000	1927	224,686,940	20,447,294
1892	75,000	55,000	1928	260,887,116	22,260,947
1893	84,000	68,500	1929	400,129,201	29,675,546
1894	85,000	75,000	1930	315,513,952	24,559,840
1895	110,000	100,000	1931	344,959,920	16,690,695
1896	131,000	110,157	1932	284,168,872	16,272,061
1897	71,300	62,657	1933	271,743,544	15,403,514
1898	111,165	74,424	1934	263,207,517	14,408,761
1899	115,110	95,000	1935	302,447,193	17,680,661
1900	40,566	34,578	1936	298,922,708	18,585,970
1901	120,800	92,034	1937	323,883,714	19,859,865
1902	120,968	99,443	1938	332,358,439	22,310,755
1903	120,134	75,237	1939	340,754,804	21,551,646
1904	144,437	91,035	1940	352,871,945	20,618,983
1905	148,345	102,479	1941	378,173,737	21,522,445
1906	168,175	109,489	1942	413,180,942	25,698,052
1907	169,991	114,759	1943	443,219,847	28,046,729
1908	842,883	474,584	1944	467,743,258	31,797,418
1909	1,148,467	616,932	1945	538,273,934	35,362,313
1910	10,579,933	1,676,367	1946	516,263,710	46,905,877
1911	5,000,000	491,859	1947	560,510,000	57,284,000
1912	12,600,000	940,076	1948	570,954,000	64,803,000
1913	14,210,836	1,053,292	1949	539,550,000	65,825,000
1914	16,529,963	1,049,470	1950	558,398,000	66,449,000
1915	21,992,892	1,706,480	1951	566,751,000	82,745,000
1916	28,134,365	2,871,751	1952	517,450,000	86,414,000
1917	44,343,020	2,964,922	1953	531,346,000	104,675,000
1918	46,373,052	3,289 524	1954	507,289,000	104,502,000
1919	52,173,503	4,041,217	1955	538,178,000	119,476,000
1920	58,567,772	3,898,286	1956	504,458,000	113,503,000
1921	67,043,797	4,704,678	1957	502,572,000	114,416,000
1922	103,628,027	6,990,030			
1923	240,405,397	15,661,433	TOTAL	4,314,634,939	$1,554,136,314

During 1957 the peat production totaled 35,916 short tons, valued at $424,362.

Table 28. Natural gas liquids produced in California counties during 1956.

County	Natural gasoline		Liquefied petroleum gases	
	Gallons	Value	Gallons	Value
Fresno	64,692,000	$6,243,000	61,289,000	$3,187,000
Kern	211,782,000	20,435,000	168,686,000	8,772,000
Kings and San Luis Obispo	26,625,000	2,577,000	11,815,000	614,000
Los Angeles	272,785,000	26,314,000	57,556,000	2,993,000
Orange	111,852,000	10,793,000	18,132,000	943,000
Santa Barbara	45,144,000	4,356,000	16,040,000	834,000
Ventura	144,022,000	13,897,000	76,714,000	3,989,000
TOTAL	876,902,000	$84,615,000	410,232,000	$21,332,000

Perlite

Crude perlite used or sold, which came from California properties in 1956, totaled 15,119 short tons and was valued at $134,861, compared with the 15,653 short tons worth $125,113 in 1955. The crude perlite came from a single property each in Inyo, Napa, and San Bernardino Counties.

Seven expanding plants in Los Angeles County and one each in Contra Costa, Fresno, Marin, Napa, Riverside, and San Diego Counties sold or used 24,158 short tons worth $1,308,381 of expanded perlite in 1956, and 25,610 short tons worth $1,349,947 in 1955. The expanded perlite was used in acoustic plaster, as an aggregate for light-weight concrete, as an insulator for sound, heat, and cold, in gypsum board, as a soil conditioner and as a filter aid.

Crude perlite produced in California during 1957 totaled 15,109 short tons valued at $113,476. Expanded perlite sold or used by California plants in 1957 totaled 23,521 short tons valued at $1,287,850.

Petroleum

In 1957 petroleum production declined for the fourth consecutive year, but increases in the price of crude oil pushed the value of the state output over the billion-dollar mark for the first time in history. A decline of 3 percent in petroleum production and an increase of 12.6 percent in value over the previous year have been reported. Production was 339,646,000 barrels, valued at $1,035,920,000.

Table 29. Petroleum produced in California counties during 1956 and 1957.

County	1956		1957	
	Barrels	Value	Barrels	Value
Fresno	35,980,000	$104,449,000	34,459,000	$111,089,000
Kern	96,485,000	244,493,000	91,508,000	273,746,000
Kings	2,437,000	7,722,000	2,103,000	7,171,000
Los Angeles	92,024,000	243,036,000	81,573,000	251,984,000
Monterey	11,733,000	18,890,000	11,845,000	23,659,000
Orange	37,051,000	95,147,000	39,812,000	120,353,000
San Luis Obispo	2,423,000	7,256,000	2,331,000	7,952,000
Santa Barbara	29,006,000	77,882,000	27,895,000	84,313,000
Ventura	43,021,000	119,427,000	46,530,000	150,128,000
Other counties	594,000	673,000	*1,590,000	*5,525,000
TOTAL	350,754,000	$918,975,000	339,646,000	$1,035,920,000

* Includes San Benito, San Bernardino, San Mateo, Sonoma, and Tulare Counties.

*Table 30. Imports of crude petroleum into California, 1956 and 1957.**

Year	Quantity (barrels)
1956	45,331,000
1957	67,118,000

* Data from U. S. Bureau of Mines.

Table 31. Annual amount and volume of petroleum produced in California, 1865-1957.

Estimate of production (barrels) to and including 1886, from Mineral Resources U. S., 1886, p. 440; estimate of values to and including 1886, made after consulting contemporaneous publications including Mining and Scientific Press, Reports of the State Mineralogist, and reports of the U. S. Geological Survey. Figures from 1887-1946 compiled from records of the State Division of Mines; 1947-1957 U. S. Bureau Mines in cooperation with California Division of Mines.

Year	Barrels	Value	Year	Barrels	Value
1865			1917	95,296,309	$86,976,209
(?)-75	175,000	$472,500	1918	99,731,177	127,459,221
1876	12,000	30,000	1919	101,182,962	142,610,563
1877	13,000	29,250	1920	103,377,361	178,394,937
1878	15,227	30,454	1921	112,599,860	203,138,225
1879	19,858	39,716	1922	138,468,222	173,381,265
1880	40,552	60,828	1923	262,875,690	242,731,309
1881	99,862	124,828	1924	228,933,471	274,652,874
1882	128,636	257,272	1925	232,492,147	330,609,829
1883	142,857	285,714	1926	224,673,281	345,546,677
1884	262,000	655,000	1927	231,195,774	260,735,498
1885	325,000	750,750	1928	231,811,465	229,998,680
1886	377,145	870,205	1929	292,534,221	321,366,863
1887	678,572	1,357,144	1930	227,328,988	271,699,046
1888	690,333	1,380,666	1931	188,310,605	141,835,723
1889	303,220	368,048	1932	177,745,286	142,890,247
1890	307,360	384,200	1933	172,139,362	143,063,972
1891	323,600	401,264	1934	174,721,282	159,529,671
1892	385,049	561,333	1935	205,979,855	179,335,311
1893	470,179	608,092	1936	214,776,227	211,667,185
1894	783,078	1,064,521	1937	238,558,562	237,845,872
1895	1,245,339	1,000,235	1938	249,395,763	258,354,343
1896	1,257,780	1,180,793	1939	224,253,110	226,358,856
1897	1,911,569	1,918,269	1940	223,294,805	207,479,800
1898	2,249,088	2,376,420	1941	229,664,784	218,838,171
1899	2,677,875	2,660,793	1942	247,491,289	242,481,545
1900	4,319,950	4,152,928	1943	284,145,702	289,323,406
1901	7,710,315	2,961,102	1944	311,717,804	330,659,802
1902	14,356,910	4,692,189	1945	328,262,400	342,756,767
1903	24,340,839	7,313,271	1946	317,116,874	386,812,146
1904	29,736,003	8,317,809	1947	333,132,000	572,990,000
1905	34,275,701	9,007,820	1948	340,074,000	822,980,000
1906	32,624,000	9,238,020	1949	332,839,000	752,220,000
1907	40,311,171	16,783,943	1950	327,607,000	707,630,000
1908	48,306,910	26,566,181	1951	354,561,000	797,760,000
1909	58,191,723	32,398,187	1952	359,415,000	801,882,000
1910	77,697,568	37,689,542	1953	364,933,000	908,680,000
1911	84,648,157	40,552,088	1954	355,865,000	907,460,000
1912	89,689,250	41,868,344	1955	354,737,000	886,820,000
1913	98,494,532	48,578,014	1956	350,754,000	918,975,000
1914	102,881,907	47,487,109	1957*	339,646,000	1,035,920,000
1915	91,146,620	43,503,837			
1916	90,262,557	57,421,334	TOTAL	11,127,525,930	$16,479,251,026

* Preliminary figures.

During 1956 a total of 350,754,000 barrels of crude petroleum, valued at $918,975,000, came from 35,287 producing wells in 14 California counties. California crude oil production is surpassed only by that of Texas.

In order to offset the decline in California production and meet the increasing demand for petroleum products, imports of crude petroleum into the state were increased substantially during the year. Most of the imported crude came from foreign countries.

Platinum

California is the leading state of the nation in the production of platinum-group metals. Crude platinum was produced in California

during 1956 and 1957 as a by-product of gold dredging along the American River in Sacramento County and along the Yuba River in Yuba County.

Potash

The potash salts produced and shipped from California sources in 1956 and 1957 came chiefly from brines processed at a plant on Searles Lake, San Bernardino County. A very small tonnage was produced from cement-mill flue dust in Contra Costa and Santa Cruz Counties. California is second among the states in the production of potash salts.

Table 32. Pumice, pumicite, and volcanic cinders produced in California counties during 1956 and 1957.

County	1956		1957	
	Short tons	Value	Short tons	Value
Inyo [a,b,c]	108,614	$650,539	82,721	$345,109
Mono [a,c]			21,499	264,944
San Bernardino [a,b,c]	59,208	87,908		
Shasta [c]	19,233	50,125	7,332	14,437
Siskiyou [a,c]	360,280	744,077	243,260	470,843
Other counties	*87,021	*801,160	†104,277	†414,798
TOTAL	634,356	$2,333,809	459,089	$1,510,131

[a]Pumice; [b]Pumicite and volcanic ash; [c]Volcanic cinders

* Includes Fresno,[a] Imperial,[a] Kern,[a] Lake,[b,c] Lassen,[c] Madera[a,b] Modoc,[a,c] and Mono,[a,c] Counties.
† Includes Fresno,[a] Imperial,[a] Kern,[a] Lake,[a,b,c] Lassen,[c] Madera,[b] Modoc,[a,c] San Bernardino.[b,c]

Table 33. Annual amount and value of pumice produced in California, 1909-57.

Year	Tons	Value	Year	Tons	Value
1909	50	$500	1935	14,890	$87,055
1910	0	0	1936	17,132	143,709
1911	0	0	1937	10,392	79,005
1912	100	2,500	1938	18,783	105,207
1913	3,590	4,500	1939	41,109	159,951
1914	50	1,000	1940	35,162	126,516
1915	380	6,400	1941	85,309	283,663
1916	1,246	18,092	1942	55,603	209,539
1917	525	5,295	1943	21,154	142,665
1918	2,114	28,669	1944	34,525	272,064
1919	2,388	43,657	1945	89,209	461,022
1920	1,537	25,890	1946	109,191	540,811
1921	406	6,310	1947	169,037	1,026,275
1922	613	4,248	1948	196,934	1,110,447
1923	2,936	16,309	1949	149,878	799,602
1924	4,919	33,404	1950	157,497	970,826
1925	5,319	32,937	1951	264,411	1,228,569
1926	7,170	48,350	1952	129,780	793,716
1927	13,779	168,896	1953	80,814	451,499
1928	10,440	105,055	1954	70,964	421,208
1929	10,449	76,123	1955	88,825	416,309
1930	12,947	128,847	1956	109,857	931,107
1931	11,711	108,130	1957	91,988	742,917
1932	9,891	86,034			
1933	8,243	61,067	TOTAL	2,162,198	$12,570,643
1934	9,951	54,748			

Pumice, Pumicite, and Volcanic Cinders

The value of the 1956 output of pumice, pumicite, and volcanic cinders was the largest of any year so far on record, but the quantity was exceeded by that of 1955. In 1957 production dropped 27 percent in quantity and 35 percent in value.

During 1956 the pumice, pumicite, and volcanic cinders produced in California totaled 634,356 short tons worth $2,333,809, of which 109,857 short tons worth $931,107 was pumice and pumicite, and 524,499 short tons worth $1,402,702 was volcanic cinders.

During 1957 the production of pumice, pumicite, and volcanic cinders in California totaled 459,089 short tons valued at $1,510,131. Pumice and pumicite production totaled 91,988 short tons valued at $742,917; volcanic cinder production totaled 367,101 short tons valued at $767,214.

Pyrite

The pyrite produced in 1956 and 1957 came from the Hornet mine at Iron Mountain, Shasta County. Annual details were concealed so as not to reveal the output of an individual. Production dropped in 1956 compared to the previous year, but remained stable in 1957.

Quicksilver

See *Mercury*.

Rare Earth Minerals

Rare earth minerals were produced commercially for the first time in California during 1952 from an open pit mine near Mountain Pass in San Bernardino County operated by the Molybdenum Corporation of America. The mineral found is bastnasite, a fluocarbonate of cerium and lanthanum. Mining continued through 1956 and 1957 and the ore was concentrated by flotation.

Salt

California is one of the principal salt-producing states. Most of the production is made by solar evaporation of sea water on the shores of southern San Francisco Bay. The quantity and value of the 1956 salt crop in California were the largest of any year on record and totaled 1,444,211 short tons worth $7,605,764. The 1957 output of salt was 1,330,060 short tons worth $8,721,242. Although production was off 8 percent in 1957, the value of salt produced was at an all-time high point.

Both the 1956 and 1957 salt production came from three properties in Alameda County, three in San Bernardino County, and one each in Kern, Monterey, Orange, and San Diego Counties. All counties, with the exception of San Bernardino, produced salt by solar evaporation.

Sand and Gravel

California leads all states in the production of sand and gravel. The California output of sand and gravel in 1956 was the largest in both quantity and value of any year on record. The overall production dipped 9 percent in 1957 owing to the slower pace of building construction and a consequently lesser demand for concrete aggregate throughout the state.

Table 34. Annual tonnage and value of salt produced in California, 1887-1957.

Year	Short tons	Value	Year	Short tons	Value
1887	28,000	$112,000	1924	318,800	$1,159,137
1888	30,800	92,400	1925	284,068	949,826
1889	21,000	63,000	1926	311,761	1,124,978
1890	8,729	57,085	1927	263,028	639,127
1891	20,094	90,303	1928	340,580	1,024,656
1892	23,570	104,788	1929	392,039	2,665,436
1893	50,500	213,000	1930	347,945	1,167,487
1894	49,131	140,087	1931	330,951	1,233,567
1895	53,031	150,576	1932	256,353	918,480
1896	64,743	153,244	1933	321,312	1,251,024
1897	67,851	157,520	1934	332,194	1,222,810
1898	93,421	170,855	1935	365,711	1,230,480
1899	82,654	149,588	1936	398,249	1,227,505
1900	89,338	204,754	1937	370,431	1,044,325
1901	126,218	366,376	1938	395,746	1,099,737
1902	115,208	205,876	1939	417,956	1,174,386
1903	102,895	211,365	1940	462,282	1,290,728
1904	95,968	187,300	1941	434,237	1,180,929
1905	77,118	141,925	1942	672,324	1,922,991
1906	101,650	213,228	1943	631,776	1,695,231
1907	88,063	310,967	1944	769,873	2,060,960
1908	121,764	281,469	1945	734,736	2,030,226
1909	155,680	414,708	1946	796,761	2,274,722
1910	174,920	395,417	1947	768,397	3,810,898
1911	173,332	324,255	1948	914,035	3,927,722
1912	185,721	383,370	1949	964,807	4,110,271
1913	204,407	462,681	1950	868,496	3,816,655
1914	223,806	583,553	1951	1,275,574	5,261,780
1915	169,028	368,737	1952	1,148,693	4,880,392
1916	186,148	455,695	1953	1,123,365	6,263,059
1917	227,825	584,373	1954	1,185,844	6,847,806
1918	212,076	806,328	1955	1,314,835	6,751,420
1919	233,994	896,963	1956	1,444,211	7,605,764
1920	230,638	972,648	1957	1,330,060	8,721,242
1921	197,989	832,702			
1922	223,238	819,187	TOTAL	26,873,957	$106,794,750
1923	275,979	1,130,670			

Production from commercial plants in 1957 was off 13 percent, but this decline was offset by an increase of 44 percent in production from so-called noncommercial plants. The noncommercial sand and gravel embraces the output from Government-and-contractor plants which supply aggregate for flood control projects, construction of dams, and the highway building program. Noncommercial production accounted for 23 percent of the total quantity of sand and gravel produced in California during 1957, compared to 14 percent of the total in 1956.

As a high percentage of sand and gravel is used in building and related construction projects, the largest production was made near large metropolitan centers. The combined value of production from Los Angeles and Alameda Counties constituted 44 percent of the state's total in 1956.

The California production of sand and gravel for 1956 totaled 86,447,000 short tons worth $96,526,000, compared with 78,982,834 short tons worth $87,030,129 in 1957. In 1956 all the counties contributed to the state's total.

Silica

Quartz and glass sand which are 98 percent or more SiO_2 have been classed as silica. For several years the Bureau of Mines has placed

Table 35. Sand and gravel produced in California counties during 1956.

County	Short tons	Value	County	Short tons	Value
Alameda [c]	9,838,805	$11,339,907	Plumas	120,170	$109,243
Butte	694,127	757,489	Riverside [a, b]	1,301,577	1,774,864
Colusa	158,900	185,458	Sacramento	3,400,325	3,940,478
Contra Costa	196,809	211,841	San Benito	158,961	119,779
Del Norte	165,920	188,394	San Bernardino	4,436,478	4,462,583
El Dorado	187,612	194,234	San Diego [a, b, c, d]	3,231,171	5,375,035
Fresno	997,527	1,170,024	San Francisco	278,852	184,240
Humboldt	1,109,393	1,122,295	San Joaquin	2,223,007	2,321,680
Imperial [d]	588,693	517,616	San Luis Obispo [b]	730,215	646,315
Inyo	164,791	148,830	Santa Barbara	751,565	952,563
Kern	1,106,645	1,807,330	Santa Clara	1,499,194	1,216,835
Lake	187,461	170,972	Santa Cruz	734,907	768,918
Lassen	447,182	463,439	Shasta	493,249	633,325
Los Angeles [b, c, d]	28,904,482	30,807,859	Siskiyou	407,384	519,503
Madera	422,777	367,327	Solano	853,394	868,800
Mariposa	90,862	145,670	Stanislaus	795,322	764,686
Mendocino	536,273	353,948	Trinity	201,277	250,012
Merced	1,778,909	1,470,102	Tulare	559,922	716,186
Modoc	213,460	209,160	Tuolumne	2,863,622	2,292,751
Mono	196,320	169,770	Ventura [b]	2,874,826	3,367,855
Monterey [a, c, d]	667,299	2,062,709	Yolo	686,162	632,609
Napa	92,558	101,264	Yuba [c, d]	608,250	959,442
Nevada	75,507	87,367	Other counties*	4,211,077	5,126,211
Orange [b]	4,094,469	4,347,366			
Placer	109,312	121,716	TOTAL	86,447,000	$96,526,000

[a] Includes glass sand; [b] Includes molding sand; [c] Includes blast sand; [d] Includes filter sand.
* Includes Alpine, Amador,[a] Calaveras, Glenn, Kings, Marin, San Mateo, Sierra, Sonoma, Sutter,[d] and Tehama Counties.

Table 36. Sand and gravel produced in California counties during 1957.

County	Short tons	Value	County	Short tons	Value
Alameda	6,881,916	$8,382,005	Riverside	2,578,043	$2,835,492
Alpine	13,000	17,560	Sacramento	3,562,043	4,384,330
Amador	143,898	371,990	San Benito	437,160	363,882
Butte	533,212	588,652	San Bernardino	4,458,056	4,519,418
Calaveras	96,524	335,558	San Diego	3,392,126	5,472,388
Colusa	246,399	193,814	San Francisco	161,672	104,864
Contra Costa	435,479	379,834	San Joaquin	1,928,668	2,016,510
Del Norte	479,639	429,995	San Luis Obispo	471,466	737,859
El Dorado	277,231	289,059	San Mateo	220,146	146,718
Fresno	1,433,981	1,633,781	Santa Barbara	462,384	838,333
Glenn	433,251	351,052	Santa Clara	1,252,989	1,355,470
Humboldt	1,595,312	1,530,941	Santa Cruz	752,472	813,561
Imperial	618,689	438,654	Shasta	1,022,124	1,263,505
Inyo	163,853	134,304	Sierra	48,694	57,419
Kern	895,669	1,282,914	Siskiyou	369,768	480,540
Kings	588,027	300,856	Solano	714,700	883,160
Lake	149,027	126,479	Sonoma, Tuolumne	1,531,014	1,524,268
Lassen	58,725	65,688	Stanislaus	877,863	908,995
Los Angeles	19,536,601	21,996,249	Sutter	138,965	111,960
Madera	1,159,920	818,618	Tehama	268,587	387,168
Marin	37,238	45,670	Trinity	1,180,123	925,032
Mariposa	59,238	96,652	Tulare	1,530,650	1,022,818
Mendocino	1,108,268	1,528,826	Tuolumne (see Sonoma)		
Merced	1,456,297	1,116,120			
Modoc	508,188	506,126	Ventura	3,109,905	3,129,115
Mono	179,939	152,244	Yolo	737,678	754,951
Monterey	887,770	1,538,859	Yuba	663,524	692,749
Napa	66,724	47,613	Not distributed by counties	1,324,414	1,425,138
Nevada	61,837	56,568			
Orange	5,007,988	4,571,099			
Placer	283,880	384,864	TOTAL	78,982,834	$87,030,129
Plumas	389,880	441,843			

*Table 37. Silver produced in California counties during 1957.**

County	Lode		Placer		Total	
	Fine oz.	Value	Fine oz.	Value	Fine oz.	Value
Alpine	8	$7			8	$7
Amador	[1]	[1]	6	$5	[1]6	[1]5
Butte	[1]	[1]	10	9	[1]10	[1]9
Calaveras	57	52			[2]57	[2]52
El Dorado	3,560	3,222	[2]	[2]	[2]3,560	[2]3,222
Fresno			27	24	27	24
Humboldt†	4,307	3,898			4,307	3,898
Imperial	200	181			200	181
Inyo	450,511	407,735			450,511	407,735
Kern	531	481	[2]	[2]	[2]531	[2]481
Los Angeles, Shasta, Yuba†	213	193	5,024	4,547	5,237	4,740
Madera, San Diego†	188	170			188	170
Mariposa	316	286	[2]	[2]	[2]316	[2]286
Mono	2,438	2,207			2,438	2,207
Nevada	952	862	41	37	993	899
Placer			26	24	26	24
Plumas	152	137	36	33	188	170
Riverside	7	6			7	6
Sacramento	19	17	[2]	[2]	[2]19	[2]17
San Bernardino	2,980	2,697			2,980	2,697
Sierra	3,187	2,884	56	51	3,243	2,935
Siskiyou	45,385	41,076	62	56	45,447	41,132
Trinity	[1]	[1]	362	328	[1]362	[1]328
Tuolumne	6	5			6	5
Not distributed by county**	36	33	1,585	1,434	1,621	1,467
TOTAL	515,053	$466,149	7,235	$6,548	522,288	$472,697

[1] Lode output withheld to avoid disclosing individual company confidential data; included with "Not distributed by county."
[2] Placer output withheld to avoid disclosing individual company confidential data; included with "Not distributed by county."
* Mine production of silver in terms of recoverable metal; compiled by the U. S. Bureau of Mines.
** Includes output indicated by (1) and (2).
† Combined to avoid disclosing individual output.

statistics for glass sand with those for Sand and Gravel; starting with 1956, quartz and ground silica sand were included with crushed rock.

Both quartz and ganister were mined from properties in San Bernardino County. Glass sand was reported from properties in Amador, Calaveras, Monterey, and Riverside Counties; fire sand was reported from Orange County.

Silver

The silver produced in California during 1956 totaled 938,139 fine ounces, worth $849,063. Most of the silver in 1956 came from the lead-zinc mines of Inyo County. Other sources of silver were gold mines in Siskiyou, Kern, and Nevada Counties and a copper mine in Amador County.

During 1957 silver production totaled 522,288 fine ounces, valued at $472,697.

Slate

The slate produced in California during 1956 and 1957 came from two properties in El Dorado County and one property in Mariposa County. The annual details are concealed so as not to reveal the output of an individual.

Table 38. Annual quantity and value of silver produced in California, 1880-1957.

(No reliable production records were kept prior to 1880. In the Division of Mines statistical bulletins issued prior to Bulletin 100 [1927], values shown for the period 1880-1904, inclusive, were taken from reports of the Director of the Mint, wherein figures for 1880-96, inclusive, were based on coinage value of $1.2929 per fine ounce. These figures have been recalculated herein to commercial value on the basis of a price table prepared by H. D. McCaskey in Mineral Resources, U. S., 1913, pt. 1, p. 847. Figures from 1905-57 have been supplied by the U. S. Geological Survey and U. S. Bureau of Mines. Figures listed under "Average price per oz.", 1934-57, inclusive, represent average price applied to newly mined silver within the United States.)

Year	Fine oz.	Value	Average price per oz.	Year	Fine oz.	Value	Average price per oz.
1880	882,169	$1,014,494	$1 15	1920	1,706,327	$1,859,896	$1 09
1881	580,091	655,503	1 13	1921	3,629,223	3,629,223	1 00
1882	653,569	745,069	1 14	1922	3,100,065	3,109,065	1 00
1883	1,129,244	1,253,461	1 11	1923	3,559,443	3,629,223	82
1884	3,236,987	3,593,056	1 11	1924	3,555,133	2,381,952	67
1885	1,968,260	2,125,298	1 07	1925	3,054,416	2,119,765	694
1886	1,245,747	1,233,290	99	1926	2,022,460	1,262,015	624
1887	1,262,282	1,237,036	98	1927	1,620,242	918,677	567
1888	1,314,874	1,235,982	94	1928	1,478,711	865,081	585
1889	823,947	774,510	94	1929	1,176,895	627,285	533
1890	820,336	861,353	1 05	1930	1,622,803	624,779	385
1891	737,224	729,852	99	1931	867,818	251,667	290
1892	358,575	311,960	87	1932	493,533	139,176	282
1893	415,468	324,065	78	1933	402,591	140,907	350
1894	229,896	144,834	63	1934	844,413	545,883	644
1895	463,911	301,542	65	1935	1,191,112	856,112	719
1896	326,757	222,195	68	1936	2,103,799	1,629,392	775
1897	754,648	452,789	60	1937	2,888,265	2,234,073	774
1898	701,788	414,055	59	1938	2,590,804	1,674,863	646
1899	855,869	513,521	60	1939	2,599,139	1,764,264	678
1900	1,168,157	724,257	62	1940	2,359,776	1,678,063	711
1901	950,831	570,499	60	1941	2,154,188	1,531,867	711
1902	1,163,041	616,412	53	1942	1,450,440	1,031,424	711
1903	958,230	517,444	54	1943	609,075	433,120	711
1904	1,441,259	835,929	58	1944	778,936	553,910	711
1905	1,076,174	650,009	61	1945	986,798	701,723	711
1906	1,220,641	817,830	68	1946	1,342,651	1,084,862	808
1907	1,138,856	751,646	66	1947	1,597,442	1,445,685	905
1908	1,647,278	873,057	53	1948	724,771	655,954	905
1909	2,098,253	1,091,092	52	1949	783,880	709,451	905
1910	1,840,085	993,646	54	1950	1,071,917	970,139	905
1911	1,270,445	673,336	53	1951	1,145,219	1,036,481	905
1912	1,300,136	799,584	61	1952	1,099,658	995,246	905
1913	1,378,399	832,553	60	1953	1,036,372	937,969	905
1914	1,471,859	813,938	553	1954	309,575	280,181	905
1915	1,678,756	851,129	507	1955	954,181	863,582	905
1916	2,564,354	1,687,345	658	1956	938,139	849,063	905
1917	1,775,431	1,462,955	824	1957	522,288	472,697	905
1918	1,427,711	1,427,711	1 00				
1919	1,107,189	1,240,051	1 12	TOTAL	107,811,225	$82,158,523	

The slate from one property in El Dorado County and from Mariposa County was flagstone. Slate from the other property in El Dorado County was crushed for roofing granules, and for slate flour for use as a filler.

Sodium Carbonate

California leads the states of the nation in the output of natural sodium carbonate. The natural sodium carbonate produced in California during 1956 to 1957 was soda ash from two properties in San Bernardino County, and soda ash and trona from a property in Inyo County. The glass and chemical industries are the principal consumers of sodium carbonate.

Sodium Sulfate

California leads the nation in the production of natural sodium sulfate salts. The sodium sulfate (salt cake and salt granules) produced in California during 1956 and 1957 came from two properties in San Bernardino County. Substantial quantities of sodium sulfate are consumed in making kraft pulp in the paper industry.

Table 39. Miscellaneous stone produced in California counties during 1956.

County	Short tons	Value	County	Short tons	Value
Alameda	1,218,764	$784,940	San Francisco	849,042	$433,663
Contra Costa	2,375,230	3,211,808	San Mateo [b]	1,593,528	1,803,299
Del Norte	118,685	192,857	Santa Clara [b]	2,225,559	1,498,639
Fresno [a]	143,953	364,355	Shasta	114,147	98,014
Humboldt	34,835	44,712	Siskiyou	109,880	109,880
Imperial	47,285	50,965	Solano	295,800	406,781
Inyo	11,580	23,739	Sonoma [c]	1,525,384	1,656,396
Kern	266,972	457,238	Tehama	10,725	32,175
Los Angeles [c]	2,336,968	3,725,604	Trinity	8,282	13,632
Marin	1,305,859	2,059,599	Tulare	46,793	70,027
Mendocino	41,655	53,975	Tuolumne [b]	724,917	1,271,510
Modoc	44,266	66,399	Yolo	38,675	68,321
Riverside [c]	962,290	1,391,041	Other counties*	3,111,449	5,510,782
Sacramento	7,886	17,631			
San Bernardino [a, b, c]	352,668	1,987,820	TOTAL	20,323,830	$28,753,742
San Diego [a]	400,753	1,347,940			

[a] Includes dimension granite; [b] Includes industrial limestone and dolomite; [c] Includes rough building stone and flagstone; [d] Includes sandstone for building.
* Includes Amador, Butte, Colusa,[d] El Dorado,[b, c] Lassen,[a] Madera,[a] Mariposa,[c] Mono, Monterey,[b, c] Napa, Orange, Placer,[a] Plumas, San Benito,[b] San Luis Obispo,[b, c] Santa Barbara,[c] Santa Cruz,[b] Ventura Counties.

Stone

Stone production in California during 1956 was reported from 46 of the state's 58 counties, and totaled 20,323,830 short tons valued at $28,753,742. Not included in these figures were 12,259,540 short tons of limestone, worth $17,354,910, which was used in the manufacture of cement and lime. These figures compare with 13,828,272 short tons worth $20,732,950 produced in 1955; not included were 10,880,049 short tons of limestone worth $16,732,950, which was used in the manufacture of cement and lime.

Of the 1956 output, 8,221 short tons, or 95,283 cubic feet, worth $897,922, was dimension granite, building, and monumental stone; and 37,098 short tons worth $718,545 was other building stone, flagstone, rubble, and dolomite.

Industrial limestone and dolomite produced in 1956 and included with the figures on stone, totaled 658,156 short tons, worth $3,377,628.

Stone produced in 1957 totaled 29,490,427 short tons valued at $37,101,897 (preliminary figures). Not included in these figures were 11,860,832 short tons of limestone used in cement and lime, valued at $16,489,192.

Strontium

The strontium mineral output in California during 1956 was the largest of any year so far recorded in the state. Production came from two properties, one in Cady Mountains of San Bernardino County,

and the other in the Fish Creek Mountains of San Diego County. The material was used as a flotation reagent and in the manufacture of strontium chemicals. The annual figures were not available.

A very small production was reported in 1957.

Table 40. Talc, soapstone, and pyrophyllite produced in California counties during 1956 and 1957.

County	1956		1957	
	Short tons	Value	Short tons	Value
Inyo	[a], [c]65,157	[a], [c]$609,484	[a]62,247	[a]$767,139
San Bernardino	[a]58,081	[a]700,022	[a]44,644	[a]626,950
San Diego	[c]3,009	[c]7,259		
Other counties	*27,463	*102,462	†27,024	†131,571
TOTAL	153,710	$1,419,227	133,915	$1,525,660

[a]Talc; [b]Soapstone; [c]Pyrophyllite

* Includes El Dorado,[b] Los Angeles,[b] and Mono [c] Counties.
† Includes El Dorado,[b] Los Angeles,[b] Mono,[c] and San Diego [c] Counties.

Table 41. Annual tonnage and value of talc produced in California, 1893-1957.

Year	Short tons	Value	Year	Short tons	Value
1893	400	$17,750	1927	16,218	$164,744
1894	0	0	1928	18,668	251,372
1895	25	375	1929	18,676	193,493
1896	0	0	1930	15,861	154,258
1897	0	0	1931	13,472	109,940
1898	0	0	1932	10,690	122,880
1899	0	0	1933	14,451	153,668
1900	0	0	1934	13,920	158,606
1901	10	119	1935	17,332	170,830
1902	14	288	1936	25,643	309,287
1903	219	10,124	1937	29,657	347,772
1904	228	2,315	1938	28,346	290,810
1905	300	3,000	1939	31,820	372,078
1906	0	0	1940	37,433	329,425
1907	0	0	1941	47,935	525,396
1908	3	48	1942	47,782	545,509
1909	33	280	1943	63,012	723,056
1910	740	7,260	1944	64,041	824,052
1911	0	0	1945	65,202	922,682
1912	1,750	7,350	1946	74,146	945,294
1913	1,350	6,150	1947	91,537	1,595,422
1914	1,000	4,500	1948	98,681	1,773,764
1915	1,663	14,750	1949	83,359	1,434,046
1916	1,703	9,831	1950	109,747	2,069,211
1917	5,267	45,279	1951	126,784	2,269,771
1918	11,760	85,534	1952	*128,154	*3,048,583
1919	8,764	115,091	1953	126,442	1,132,700
1920	11,327	221,362	1954	133,474	1,211,201
1921	8,752	130,078	1955	166,551	1,552,783
1922	13,378	197,186	1956	153,710	1,419,227
1923	17,439	252,661	1957	133,915	1,525,660
1924	16,179	242,770			
1925	15,465	239,084	TOTAL	2,141,432	$28,516,350
1926	17,004	255,645			

* Some of this production was reported as ground material with a much higher unit value than for crude.

Sulfur

Nearly all the sulfur ore mined in California during 1956 and 1957 came from the open pit Leviathan mine in Alpine County. The sulfur content (30 percent) was converted into sulfuric acid at Weed Heights, Nevada, and used to leach a low-grade copper carbonate ore from a deposit near Yerington, Nevada.

A small production of sulfur ore was made in 1957 from the Crater claims near Big Pine, Inyo County, and from the Sulfur Bank mercury mine in Lake County. The material was used as a soil additive.

By-product sulfur was produced from petroleum refineries in Contra Costa, Los Angeles, and San Luis Obispo Counties; by-product hydrogen sulfide from petroleum refineries in Contra Costa and Los Angeles Counties; and liquid sulfur dioxide and sulfuric acid from a lead smelter in Contra Costa County.

Talc, Soapstone, and Pyrophyllite

During 1956 talc, soapstone, and pyrophyllite totaling 153,710 short tons worth $1,419,227 were produced. Production came from 17 properties in San Bernardino County, 13 properties in Inyo County, three properties in San Diego County, two in El Dorado County and one property each in Los Angeles and Mono Counties.

The material from Inyo County and from all but one property in San Bernardino County was talc; that from El Dorado and Los Angeles Counties was soapstone; and that from Mono and San Diego Counties, and from one property in San Bernardino County, was pyrophyllite.

Production during 1957 totaled 133,915 short tons valued at $1,525,660.

The production from Inyo County and most of the production from San Bernardino County was high-grade talc. Pyrophyllite came from Mono, Plumas, San Bernardino, and San Diego Counties; the soapstone came from El Dorado, Los Angeles, and Riverside Counties.

Titanium Concentrate

No titanium ore or concentrates were reported shipped in California during 1956 and 1957.

Tungsten

The tungsten ore and concentrates shipped from California mines during 1956 totaled 223,155 units of WO_3 or 3,719 short tons of 60 percent WO_3 valued at $13,449,378, coming from mines in 16 counties. The 1956 output was somewhat less than that of 1955 when 262,881 units of WO_3 or 4,383 short tons of 60 percent WO_3 worth $16,200,924, coming from mines in 20 counties, was reported.

Production in 1957 totaled 1,750 short tons of 60 percent WO_3 valued at $2,735,160.

The U. S. Government stockpile program for the purchase of domestic tungsten concentrates at $63 per unit was completed in July 1956. In the same month a new program was set up under Public Law 733, calling for payment at the price of $55 per unit. Funds were appropriated only for about 285,000 units of the total of 1,250,000 units. Purchases were made under the new program until November 1956.

Table 42. Tungsten produced in California counties during 1956.

County	Units	Value	County	Units	Value
Fresno	1,672	$97,142	Tulare	7,330	$433,746
Inyo	124,283	7,556,340	Other counties*	71,463	4,268,572
Kern	1,888	114,342			
Riverside	23	1,399	TOTAL	223,155	$13,449,378
San Bernardino	16,496	977,837			

* Includes Alpine, Calaveras, El Dorado, Madera, Mariposa, Mono, Nevada, Placer, San Diego and Tuolumne Counties.

Table 43. Annual tonnage and value of tungsten produced in California, 1905-1957.

NOTE: Where necessary in order to conceal output of individual producers, production figures are combined to cover a 2-year period (1927-28, etc.).

Year	Tons at 60% WO_3	Value	Average unit WO_3 value	Year	Tons at 60% WO_3	Value	Average unit WO_3 value
1905	57	$18,800	$5 50	1935	218	$194,542	$14 87
1906	485	189,100	6 50	1936	236	210,819	14 89
1907	287	120,587	7 00	1937	611	782,187	21 34
1908	105	37,750	5 99	1938	732	786,860	17 92
1909	577	190,500	6 50	1939	1,235	1,153,735	15 47
1910	457	208,245	7 60	1940	1,784	2,267,135	21 15
1911	387	127,706	5 50	1941	2,860	4,080,628	23 77
1912	572	206,000	6 00	1942	3,853	5,586,770	24 16
1913	559	234,673	7 00	1943	4,235	5,910,745	23 26
1914	420	180,575	7 17	1944	3,399	4,835,810	23 71
1915	962	1,005,467	17 42	1945	1,192	1,587,951	22 21
1916	2,270	4,571,521	33 57	1946	1,709	2,072,680	20 22
1917	2,466	3,079,013	20 81	1947	394	548,233	23 43
1918	1,982	2,832,222	24 82	1948	1,767	*4,417,435	26 27
1919	214	219,316	17 08	1949	952		26 38
1920-22	0	0		1950	2,025	3,392,000	28 25
1923	34	19,126	8 17	1951	3,007	11,557,325	61 02
1924	781	446,009	9 52	1952	2,980	11,360,596	63 44
1925	573	348,475	10 14	1953	2,123	8,906,808	62 46
1926	441	316,560	11 96	1954	3,512	13,209,371	62 61
1927-28	649	429,237	11 03	1955	4,383	16,200,924	61 79
1929	150	106,280	11 81	1956	3,719	13,449,378	57 90
1930-31	120	82,582	11 47	1957	1,750	2,735,160	24 72
1932	26	9,509	6 10				
1933	148	76,605	8 63	TOTAL	63,659	$130,527,367	
1934	261	224,417	14 33				

* Combined to conceal production of individual producers.

Purchase funds were then exhausted and production ceased almost completely.

Uranium

Public interest in prospecting for uranium, which has been stimulated during recent years, reached a high point during 1954 and 1955. The first truckload shipment of uranium ore was made from a property in San Bernardino County on July 14, 1954. On July 31, 1954, the first carload shipment of uranium ore was made from the Miracle mine in Kern County.

PHOTO 5. Camp buildings at the Strawberry tungsten mine in the high Sierra, 85 miles east of Madera, Madera County. This mine shipped tungsten concentrates to the General Services Administration under the program which terminated in 1956.

A relatively small tonnage of ore was shipped also during 1955. Exploration work was reported in Lassen, Plumas, Calaveras, Kern, Inyo, and Monterey Counties. An operator of uranium claims in Kern County adapted a mill near Mojave to the treatment of uranium ore on an experimental basis. A deposit in Inyo County was explored in 1956 under the U. S. Government DMEA program.

A small production of uranium ore was made also in 1956 and 1957. In 1956 the quantity of uranium ore produced was 1,903 pounds (U_3O_8 content) valued at $5,160. The producing counties were Kern, Imperial, Inyo, Madera, Mono, and Tuolumne. In 1957 the producing counties were Kern, Lassen, and Madera.

Wollastonite

During 1956 and 1957 a small tonnage of wollastonite was reported in California from properties in Riverside County. It was used as ornamental stone and the output was tabulated under "Stone."

Zinc

During 1956 a total of 16,098,000 pounds of zinc worth $2,205,426 was produced in California.

Most of the California zinc production in recent years has come from the lead-zinc mines of Inyo County. The closing of these mines about mid-1957 resulted in a drop in zinc production compared to the previous year. The 1957 production was 5,938,000 pounds valued at $688,808 for the entire state.

Table 44. Zinc produced in California counties during 1956 and 1957.

County	1956		1957*	
	Pounds	Value	Pounds	Value
El Dorado			13,200	$1,531
Imperial			1,400	162
Inyo	16,044,800	$2,198,138	5,908,200	685,351
San Bernardino	8,800	1,205	15,100	1,752
Sierra			100	12
Other counties	†44,400	†6,083		
TOTAL	16,098,000	$2,205,426	5,938,000	$688,808

* Mine production in terms of recoverable metals; compiled by the U. S. Bureau of Mines.
† Includes El Dorado, Kern, and Shasta Counties.

Table 45. Annual poundage and value of zinc produced in California, 1906-1957.

Year	Pounds	Value	Year	Pounds	Value
1906	206,000	$12,566	1934	721,719	$31,034
1907	177,759	10,598	1935	328,013	14,432
1908	54,000	3,544	1936	29,740	1,487
1909	0	0	1937	39,643	2,577
1910	0	0	1938	17,554	843
1911	2,679,842	152,751	1939	16,390	852
1912	4,331,391	298,866	1940	182,088	11,472
1913	1,157,947	64,845	1941	880,612	66,046
1914	399,641	20,381	1942	1,275,906	118,659
1915	13,043,411	1,617,383	1943	5,170,627	558,427
1916	15,950,565	2,137,375	1944	16,456,103	1,875,996
1917	11,854,804	1,209,190	1945	19,340,732	2,224,184
1918	5,565,516	506,466	1946	14,639,804	1,786,056
1919	1,384,192	101,046	1947	10,930,000	1,310,430
1920	1,188,009	96,229	1948	10,650,000	1,416,450
1921	846,184	42,309	1949	14,418,000	1,787,832
1922	3,034,430	172,963	1950	15,102,000	2,144,484
1923	0	0	1951	19,204,000	3,495,128
1924	3,060,000	198,900	1952	18,838,000	3,127,108
1925	11,546,602	877,542	1953	10,716,000	1,232,340
1926	20,447,559	1,533,568	1954	2,830,000	305,640
1927	8,625,004	552,000	1955	13,672,000	1,681,656
1928	0	0	1956	16,098,000	2,205,426
1929-30	0	0	1957	5,938,000	688,808
1931	149,865	5,314			
1932	0	0	TOTAL	303,487,874	$35,713,392
1933	290,222	12,189			

Zirconium

During 1956 and 1957 no zirconium was reported produced in California. At a property near Rocklin, Placer County, some development work was done which may lead to the possible future production of zircon, ilmenite, and rutile, and minor amounts of monazite, scheelite, and chromite.

DIRECTORY OF CALIFORNIA MINERAL PRODUCERS, DEALERS, AND LABORATORIES

Prepared by Henry H. Symons * and Fenelon F. Davis *

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* Mining Engineer and Mining Geologist, respectively, California Division of Mines.

DIRECTORY OF MINERAL PRODUCERS IN CALIFORNIA FOR 1957 *

Asbestos

Mine	Operator	Address	Location
Inyo County:			
Tin Mountain (amphibole)	Huntley Industrial Minerals, Inc.	P.O. Box 305, Bishop	Lone Pine
Napa County:			
Phoenix (chrysotile)	Tabor Mining Co.	1023 Woodside Dr., Napa	Steel Canyon

Barite

Operator	Address	Location
Nevada County:		
Baroid Division, National Lead Co.	P.O Box 1675, Houston, Texas	Washington
San Bernardino County:		
Oil Base Inc.	130 Oris St., Compton	Barstow
Tulare County:		
Macco Corp., Drilling Fluids Division	14409 S. Paramount Blvd., Paramount	Linnie
C. A. Hervert	Olancha	Nine Mile Canyon

* Addresses corrected to 1958. Producers of natural gas and petroleum may be found in the "Summary of Operations, California Oil Fields," July-December 1957, vol. 43, no. 2, of the State Division of Oil and Gas.

Borates

Operator	Address	Location
Inyo County:		
Pacific Coast Borax Division, U. S. Borax & Chemical Corp.	P.O. Box 9128, Sta. S, Los Angeles 5	Shoshone
Kern County:		
Pacific Coast Borax Division, U. S. Borax & Chemical Corp.	P.O. Box 9128, Sta. S, Los Angeles 5	Boron
San Bernardino County:		
American Potash and Chemical Corp.	3030 W. Sixth St., Los Angeles 54	Trona
West End Chemical Division, Stauffer Chemical Co.	1956 Webster St., Oakland 12	Westend

Bromine

Operator	Address	Location
Alameda County:		
Westvaco Mineral Products Division, Food Machinery and Chemical Corp.	405 Lexington Ave., New York, N. Y.	Newark
San Bernardino County:		
American Potash and Chemical Co.	3030 W. Sixth St., Los Angeles 54	Trona

Calcium Chloride

Operator	Address	Location
San Bernardino County:		
California Rock Salt Co.	2436 Hunter St., Los Angeles 21	Amboy
Hill Brothers Chemical Co.	2159 Bay St., Los Angeles 21	Amboy
National Chloride Company of America	Rm. 625, 433 S. Spring St., Los Angeles 13	Amboy

Cement

Operator	Address	Location
Calaveras County:		
Calaveras Cement Co.	315 Montgomery St., San Francisco 6	San Andreas
Kern County:		
Monolith Portland Cement Co.	Box 65947 Glassell Sta., Los Angeles 65	Monolith
California Portland Cement Co.	612 S. Flower St., Los Angeles 17	Creal
Los Angeles County:		
Blue Diamond Corp.	1650 S. Alameda St., Los Angeles 54	Los Angeles
Riverside County:		
Riverside Cement Co.	621 S. Hope St., Los Angeles 17	Crestmore
San Benito County:		
Ideal Cement Co.	620 Denver Nat. Bank Bldg., Denver 2, Colo.	San Juan Bautista
San Bernardino County:		
California Portland Cement Co.	612 S. Flower St., Los Angeles 17	Colton
Permanente Cement Co.	Lucerne Valley	Lucerne Valley
Riverside Cement Co.	621 S. Hope St., Los Angeles 17	Oro Grande
Southwestern Portland Cement Co.	1034 Wilshire Blvd., Los Angeles 17	Victorville
San Mateo County:		
Ideal Cement Co.	620 Denver Nat. Bank Bldg., Denver 2, Colo.	Redwood City
Santa Clara County:		
Permanente Cement Co.	Permanente	Permanente
Santa Cruz County:		
Pacific Cement & Aggregates, Inc.	400 Alabama St., San Francisco 10	Davenport

Mine	Operator	Address	Location
Alameda County:			
Cedar Mountain	Palo Alto Mining Corp.	14900 Coleman Rd., San Jose 24	Livermore
Butte County:			
Lambert (Magalia)	Castella Mining & Milling Co.	24 California St., San Francisco	Magalia
Mary Jane	L. A. Farnham	P.O. Box 12, Scott Bar	Horse Creek
Colusa County:			
Hi Noon No. 1 and Machiljay	Machiljay Mines	Harold S. Hill, Box 323, Arbuckle	Stonyford
Del Norte County:			
Azalea	W. O. Burch	Rt. 1, Box 846, Cave Junction, Oregon	Crescent City
Baldy	Howard Beasley	Box 15, Takilma, Oregon	--
Bartender	Jack Eggers	Rt. 1, Box 154, Cave Junction, Oregon	--
Bear Wallo	R. E. Woods	Murphy, Oregon	Crescent City
Big Lift	Simonson Logging Co.	Box 199, Smith River	Smith River
Black Jack	Herman Weeks	Box 95, Scott Bar	Gasquet
Blue Creek Tunnel	R. H. Ellison	Weitchpec	Orleans
Bluff Creek	Bluff Creek Mining Co.	Cave Junction, Oregon	--
Buckskin-Bar Rick	C. H. McClendon	P.O. Box 61, Crescent City	Gasquet
Camp No. 7	M. Guscette	Box 234, Selma, Oregon	--
Chrome Hill	E. F. McClain	P.O. Box 1037, Brookings, Oregon	--
Cowboy	John H. Wigham	Box 146, Smith River	Smith River
Crack-of-Dawn	Jack Eggers	Rt. 1, Box 154, Cave Junction, Oregon	Gasquet
Debbie	Geo. Schicora	P.O. Box 803, Crescent City	Crescent City
Drake property	Waldo Milling Co.	Cave Junction, Oregon	--
Freeloader	Jack Eggers	Rt. 1, Box 154, Cave Junction, Oregon	--
French Hill	L. J. Whippo and R. J. Towlerton	Box 332, Gasquet	Gasquet
Hambro No. 18	M. C. Brown and L. Schmid	P.O. Box 627, Crescent City	Smith River
Hard Scrabble	C. Sawyer and Geo. Schicora	Star Route Box 316, Crescent City	--
High Plateau	Eugene R. Brown	Box 23, O'Brien, Oregon	O'Brien, Oregon
High Plateau	Tulare Mining Co.	731 Burgess St., Grants Pass, Oregon	O'Brien, Oregon
Holiday	Holiday Mines	P.O. Box 1037, Brookings, Oregon	Patrick Creek
Hoot Owl	H. R. Darrow	P.O. Box 473, Grants Pass, Oregon	--
Midnight	L. Flanders	394 McNamara St., Crescent City	Crescent City
Muzzle Loader	Jack Eggers	Rt. 1, Box 154, Cave Junction, Oregon	--
Old Doe	Harold T. Funk	711 SW. Greenwood Dr., Grants Pass, Oregon	Smith River
Pioneer	H. L. Germain	P.O. Box 846, Crescent City, Oregon	--
Prosperity (Camp 7)	J. W. Gahm	1918 Nebraska Ave., Grants Pass, Oregon	Gasquet

Chromite—Continued

Mine	Operator	Address	Location
Del Norte County:—Continued			
Rough & Ready	M. Wood and Richard Dixon	1387 Fifth St., Crescent City	Gasquet
Rowdy Creek	M. C. Brown and L. Schmid	P.O. Box 42, Crescent City	Smith River
Sunrise No. 2	Howard Beasley	Box 15, Takilma, Oregon	Gasquet
Sunrise	Ross and Sharnek	Box 612, Fortuna	Gasquet
Surprise	James Thuney	Rt. 1, Box 488, Crescent City, Oregon	Crescent City
Twin Ridge	Gross and Kaufman	Box 536, Grants Pass, Oregon	Gasquet
Zinc Saddle	Zinc Saddle Mining Co.	439 S. Second St., Springfield, Oregon	Gasquet
El Dorado County:			
Pilliken	Western Chrome Products	P.O. Box 162, Auburn	Pilot Hill
Russel J. Wilson property	Lester Miller	P.O. Box 32, Greenwood	Georgetown
Fresno County:			
Big Ridge	J. R. Holman	1465 E. Orange Grove Ave., Pasadena	Coalinga
Butler Estate No. 1	Southwest Oil Co.	c/o E. F. Chalmers, 569 Sunset St., Los Angeles 44	Coalinga
Lot No. 8	Myco Mining Corp.	P.O. Box 368, Coalinga	Coalinga
Glenn County:			
Burrows	David Chalmers	P.O. Box 486, Elk Creek	Newville
Humboldt County:			
Twin Lakes	Lambert Logging Co.	Box 155, Orleans	Orleans
White Cedar	Dan Haight	Smith River	Martins Ferry
Mendocino County:			
Red Mountain	Carl Hansen and Associates	818 Broadway, Eureka	Leggett
Red Mountain	C. C. Kirk	P.O. Box 56, Piercy	Leggett
Monterey County:			
Lilly group	Monte Young	Box 43, San Simeon	San Simeon
South Slope	Virginia Swanson	513 Fremont St., Salinas	San Simeon
Treasure Chest	Virginia Swanson	513 Fremont St., Salinas	San Simeon
Napa County:			
Grubstake No. 1	Clyde Davis	Rt. 1, Box 426, Redwood Valley	Middletown

Placer County:			
Black Nugget	Thomas L. Hancock	Box 37, Dutch Flat	Bear River
Capitol Co.	Blake Teague	General Delivery, Foresthill	Foresthill
Pitt 47	Blake Teague	General Delivery, Foresthill	Foresthill
Two Cedar	F. Turner, P. Beatty, and C. Hills	P.O. Box 374, Foresthill	Foresthill
Plumas County:			
Mine Spike	Robert G. Ridley	Meadow Valley	--
White Pine	Herman Weeks	Box 95, Scott Bar	--
San Benito County:			
Margaret	Charles Leeper, Jr.	Rt. 1, Box 200, Aptos	Clear Creek
Sawmill Creek	Hampton Mining Co.	274 S. Lafayette Park Pl., Los Angeles 4	Idria
San Luis Obispo County:			
Castro	Castro Mining Co.	c/o Durand Hall, 625 Market St., San Francisco	San Luis Obispo
Hardface	Pierce Bros.	P.O. Box 386, Morro Bay	--
London	Harry J. Stevens	Box 186, Cayucos	San Luis Obispo
Norcross	H. C. Dalessi	Box 465, San Luis Obispo	San Luis Obispo
Norcross	John D. Hoffman	778 Marsh St., San Luis Obispo	San Luis Obispo
Old Creek No. 1	Harold Ratliff	Box 1282, Morro Bay	Cayucos
Old Creek No. 1	Harry J. Stevens	Box 186, Cayucos	Cayucos
Pick and Shovel	W. D. Pierce	803 Fourth St., Morro Bay	San Luis Obispo
Sweet Water	Ruda and Negranti	Box 465, Cayucos	Morro Bay
Sweetwater	J. D. Hoffman	778 Marsh St., San Luis Obispo	Morro Bay
Trinidad group	Pierce Bros.	803 Fourth St., Morro Bay	San Luis Obispo
Santa Barbara County:			
Davis	Davis Mining Co.	Rt. 1, Box 158, Santa Maria	Santa Ynez
Shasta County:			
Cadillac group	C. H. Hoffman and J. W. Hall	Box 142, Proberta	Platina
Castella Mill	Castella Mining & Milling Co.	24 California St., San Francisco 11	Castella
North Fork Queen	Fred Van Radar	1180 Twinview Blvd., Redding	Platina
Siskiyou County:			
Alex Markin	Charles Snapp	Box 102, Etna	Callahan
Besock	Jerry Kramer	Etna	--
Blue Stone	L. A. Farnham	Scott Bar	--
Blue Stone	P. M. Watkins and L. A. Farnham	Horse Creek	--
Blue Thorn	O. W. Gould and Henry Kaiser	Cecilville	Cecilville
Chrome Ridge	L. & Y. Mining Co.	Warrens Bldg., Yreka	--

Chromite—Continued

Mine	Operator	Address	Location
Siskiyou County;—Continued			
Circle "D"	Herman Weeks	Box 95, Scott Bar	--
Cyclone Gap	J. G. Gallaher	716 NE "A" St., Grants Pass, Oregon	--
De Faria	D. C. De Faria	P. O. Box 406, Etna	Callahan and Etna
Dry Gulch group	Virgil A. Grey	Box 9, Etna	Cecilville
East Fork	J. P. Hullquist and H. F. Johnson	Happy Camp	Happy Camp
Eddy Creek	D. G. Thompson	Box 521, Yreka	--
Emma Bell	Ashland Mining Co.	835 N. Main, Ashland, Oregon	Seiad
Emma Bell	L. A. and Sue Farnham	Box 12, Scott Bar	Seiad
Fairview	Ashland Mining Co.	835 N. Main St., Ashland, Oregon	--
Floyd L. Munson	Floyd L. Munson	Box 315, Etna	Callahan
Gazelle	Ashland Mining Co.	835 N. Main St., Ashland, Oregon	Gazelle and Callahan
Gazelle Mountain (Masterson)	J. A. Richter	Box 297, Callahan	Gazelle and Callahan
J. D. Nicely	Paul M. Watkins	Horse Creek	--
Janie Bob	L & Y Mining Co.	Warren's Bldg., Yreka	--
Kitty Hawk	P. M. Watkins and L. A. Farnham	Horse Creek	--
L & Y	L & Y Mining Co.	Warren's Bldg., Yreka	Scott Bar
Lady Grey	Russ Hogue	Box 5, Scott Bar	Yreka and Scott Bar
Lady Grey	J. H. Watkins	Scott Bar	Yreka
Little Castle	Castella Mining & Milling Co.	24 California St., San Francisco	Dunsmuir
Lucky Strike	Basil Wild	Box 342, Greenview	Seiad
Lucky Strike	Donald Winn	Post Office, Klamath River	Seiad
M. A. L.	Harry A. Lundblad	1155 Seventh St., Novato	--
Martha	Clarence Yost	Rt. 1, Box 4148, Medford, Oregon	--
Moffett Creek	D. G. Thompson	Box 521, Yreka	Yreka
Mountain View	P. M. Watkins and L. A. Farnham	Horse Creek	--
Mountain View No. 10	Herman Weeks	Box 95, Scott Bar	Seiad
Mule Shoe	Winfred Bingham	Warrens Bldg., Yreka	--
Oro Grande	Daniel W. Hatcher	Gen'l. Del., Yreka	Rocky Gulch
Peg Leg	Jack Hottendorf	Etna	--
Railroad Lease	Jack Hottendorf	Etna	Fort Jones
S & W	Arnold Tschopp	Fort Jones	Fort Jones and Yreka
Scott Valley Hole	Basil Wild	Box 342, Greenview	Etna
Simas	Frank Walden	Gen'l. Del., Fort Jones	Fort Jones
Vincent Burke	Jerry and Ed Kramer	Box 68, Etna	--
Wynn	F. L. Merrill	Scott Bar	--

Sonoma County:			
Meadowlark	John E. Gates	c/o Mobillong Trailer Ct., Healdsburg	Healdsburg
Stanislaus County:			
Black Bart and Black Ace	Del Puerto Mining Co.	Box 1164, Patterson	Patterson
Del Puerto	Del Puerto Mining Co.	77 E. Santa Clara St., San Jose	Patterson
Del Puerto Parks No. 1 and No. 2	Del Puerto Mining Co.	Box 1164, Patterson	Patterson
Tehama County:			
Apex and Tops	Charles T. Shaw	Gen'l. Del., Platina	--
Grau	Dave Brundage	P.O. Box 603, Red Bluff	Red Bluff
Grau and Kleinsorge	Jubilee Mining Co.	404 Zion's Savings Bank Bldg., Salt Lake City, Utah	Red Bluff
Grau	Richland Mining Co.	P.O. Box 603, Red Bluff	Red Bluff
Trinity County:			
Costa	Ashland Mining Co.	835 N. Main St., Ashland, Oregon	Castella
Lost Dog	E. A. Lough	P.O. Box 636, Hayfork	Big Bar
Tuolumne County:			
McCormick	W. R. Williamson	P.O. Box 60, Jamestown	Jamestown
Mum	A. E. Hemming	c/o C. Springs, P.O. Box 510, Sonora	--
Old McCormick	A. E. and A. M. Hemming	P.O. Box 510, Sonora	Sonora

Clay

Operator	Product*	Address	Location
Alameda County:			
Bell Sand & Gravel	a	P.O. Box 282, Irvington	Irvington
California Pottery Co.	a	P.O. Box 68, Niles	Niles
Interlocking Roof Tile Co.	a	Rt. 1, Box 488, Niles	Niles
Kraftile Co.	a	Niles	Niles
Lowrie Paving Co.	f	1755 Evans Ave., San Francisco 24	Tesla
Amador County:			
Gladding, McBean & Co.	f	2901 Los Feliz Blvd., Los Angeles 39	Ione
Ione Clay & Sand Corp.	a,f	P.O. Box 25, Ione	Ione
Pacific Clay Products Co.	f	1255 W. Fourth St., Los Angeles	Ione
Western Refractories Co.	f	P.O. Box 169, Ione	Ione
Calaveras County:			
California Pottery Co.	a,f	P.O. Box 68, Niles	Valley Springs
Pacific Clay Products Co.	a	1255 W. Fourth St., Los Angeles	Valley Springs
Contra Costa County:			
Port Costa Brick Works (G. C. Berg, pres.)	a	401 Berry St., San Francisco 7	Port Costa
United Materials & Richmond Brick Co., Ltd.	a	Box 7, Point Richmond 3	Richmond
Fresno County:			
Craycroft Brick Co.	a	P.O. Box 814, Fresno	Fresno
Inyo County:			
Mason & Co.	g	P.O. Box 111, Olancha	Olancha
Multi Mines, Inc.	b	2552 E. Olympic Blvd., Los Angeles 23	Tecopa
Sierra Talc & Clay Co.	g	1608 Huntington Dr., South Pasadena	Olancha
Silicates Corp. (L. R. Moretti, trustee)	b	100 Palm Ave., San Rafael	Death Valley Junction
Kern County:			
American Mineral Co.	a	840 S. Mission Rd., Los Angeles 23	Cantil
Excel Minerals Co.	e	3461 E. 26th St., Los Angeles	Taft
Macco Corp.	h	14409 S. Paramount Blvd., Paramount	Rosamond
McKittrick Mud Co.	h	Box 356, McKittrick	McKittrick
Mojave Corp.	b,h	12827 E. Imperial Highway, Norwalk	Muroc

Los Angeles County:			
Angulo Tile Co.	a	P.O. Box 97, 19044 Kittridge St., Reseda	Reseda
Atkinson Brick Co.	a	13633 S. Central Ave., Los Angeles 59	Los Angeles
Builders Brick Co.	a	P.O. Box 266, Gardena	Compton
Castaic Brick Co.	a	P.O. Box 180, Castaic	Castaic
Davidson Brick Co.	a	4701 E. Floral Dr., Los Angeles 22	Los Angeles
Gladding, McBean & Co.	a	2901 Los Feliz Blvd., Los Angeles 39	Tropico, Los Angeles, Santa Monica, Pico
Higgins Brick & Tile Co.	a	2217 W. 174th St., Torrance	Moneta
Katz, Dr. Leon N.	a	9837 Foothill Blvd., San Fernando	Sunland
Maybow Building Materials & Suppliers, Inc.	a	P.O. Box 517, Harbor City	Los Angeles
Sun Valle Tile Kilns	a	1258 N. Highland Ave., Los Angeles 38	Reseda
Valley Brick & Supply Co.	a	6151 Kester Ave., Van Nuys	Van Nuys
Marin County:			
McNear Brick Co.	a	P.O. Box 119, McNear Point, San Rafael	McNear Point
Mono County:			
Huntley Industrial Minerals	c	P.O. Box 305, Bishop	Laws
Orange County:			
I. P. Arnold	c,i	7655 E. Second Ave., Downey	El Toro
California Non Metallics	c	Robinson Ranch, Trabuco Canyon	El Toro
B. B. Garret, or Mission Clay Products Corp.	a	Box 132, 1696 E. Santiago Ave., Olive	Olive
Gladding, McBean & Co.	f	2901 Los Feliz Blvd., Los Angeles 39	Irvine, Claymont, Prado
La Bolsa Tile Co.	a	R.F.D. 18404 Gothard St., Huntington Beach	Smeltzer
Pacific Clay Products Co.	f	1255 W. Fourth St., Los Angeles	Irvine
W. A. Schoeppe	c	P.O. Box 101, El Toro	El Toro
Placer County:			
Gladding, McBean & Co.	f	2901 Los Feliz Blvd., Los Angeles 39	Lincoln
Lincoln Clay Products Co.	f	P.O. Box 367, Lincoln	Lincoln
Riverside County:			
Atlas Sewer Pipe Co.	a	10009 S. Painter St., Whittier	Corona
Joe Deleo Jr., contractor	a,f	1233 Garretson Ave., Corona	Temescal Canyon
Elsinore Clay Co.	f	Highgrove	Elsinore
Gladding, McBean & Co.	a,f	2901 Los Feliz Blvd., Los Angeles 39	Corona, Elsinore
Liston Brick Co.	a	P.O. Box 7, Corona	Corona
Los Angeles Brick & Clay Products Co.	f	1078 N. Mission Rd., Los Angeles 33	Alberhill
Pacific Clay Products Co.	f	1255 W. Fourth St., Los Angeles	Corona
Tillotson, John, dba Sky Ranch Clay Co.	f	P.O. Box 398, Corona	Corona

Clay—Continued

Operator	Product*	Address	Location
Sacramento County:			
Cannon Co.	a	Box 802, Sacramento 4	Ben Ali, Michigan Bar
Harrison Fait	i	1950 Howe Ave., North Sacramento 21	North Sacramento
Robideaux, J. J.	f	4805 Yosemite Ave., Sacramento	Near Ione
Sacramento Brick Co.	a	P.O. Box 844, Sacramento 4	Sacramento
San Benito County:			
Lewis, C. Hyde	b	Idria	Idria
San Benito Clay & Mineral Co.	b	237 Pruneridge Ave., Santa Clara	Tres Pinos
San Bernardino County:			
B. & W. Tile Mfg. Co.	d	14600 S. Western Ave., Gardena	Ivanpah
Baroid Sales Div., National Lead Co.	b	P.O. Box 1675, Houston 1, Texas	Hector
Brown Minerals Co.	b	4553 N. Kassebaum Ave., El Monte	Vidal
Gladding, McBean & Co.	c	2901 Los Feliz Blvd., Los Angeles 39	Goff
Hancock Brick Co.	a,i	Highgrove	Highgrove
Inerto Co.	b	1489 Folsom St., San Francisco 3	Newberry
Pomona Brick Co.	a	P.O. Box 239, Pomona	Chino
Southern California Minerals Co. (W. K. Skeoch)	d	320 S. Mission Rd., Los Angeles 33	Baker
San Diego County:			
Hazard Bloc Co.	a	Cabrillo Freeway and Friars Rd., Mission Valley, San Diego	San Diego
Mission Valley Brick Co.	f	Friars Rd., San Diego	San Diego
Sorrento Brick & Clay Products, Inc.	a	Box 183, Sorrento	San Diego
Union Brick Co.	a	7351 Pacific Highway, San Diego 9	Rose Canyon
San Joaquin County:			
Stockton Brick & Tile Co.	a	P.O. Box 547, Stockton	Stockton
Stockton Building Materials	a	711 S. Madison St., Stockton 4	Stockton
San Luis Obispo County:			
Faulstich Bros., San Luis Brick, Inc.	a	Box 122-D, Rt. 2, San Luis Obispo	San Luis Obispo
Santa Barbara County:			
McNall Building Materials	a	P.O. Box 758, Santa Barbara	San Marcos

Santa Clara County:			
Gladding Bros. Mfg. Co.	a	P.O. Box 88, S. Third and Keyes St., San Jose 12	San Jose
Remillard-Dandini Co.	a	Storey Rd., San Jose	San Jose
Solano County:			
Basalt Rock Co., Inc.	a	Eighth and River Sts., Napa	Chabot Acres
Sonoma County:			
Jolliff, Larry	a	Forestville	Forestville
Malugani, Joe	a	581 Silva Ave., Santa Rosa	Mark West
Stanislaus County:			
Clayton and Lester Raggio	f	Box 27, Knights Ferry	Cooperstown
Sutter County:			
Gladding, McBean & Co.	a	2901 Los Feliz Blvd., Los Angeles 39	Nicolaus
Tulare County:			
S.P. Brick & Tile Co.	a	P.O. Box 568, Fresno	Exeter
Ventura County:			
Ridgelite Products, Inc.	a	P.O. Box 723, Arcadia	Frazier Park
Rocklite Products	a	1800 N. Ventura Ave., Ventura	Ventura
Shell Oil Co., Dent clay pit	h	Shell Bldg., San Francisco	Ventura
Yuba County:			
Gladding, McBean & Co.	a	2901 Los Feliz Blvd., Los Angeles 39	Wheatland

* a, Miscellaneous clay; b, Bentonite; c, Kaolin or china clay; d, Ball clay; e, Diatomaceous clay; f, Fire clay; g, Fullers earth; h, Oil well drilling mud; i, Fire sand and ganister.

Coal

Operator	Address	Location
Amador County:		
American Lignite Products Co.	Ione	Ione

Copper *

Mine	Operator	Address	Post office of mine
Calaveras County:			
Penn	William A. Hooton	Campo Seco	Campo Seco
El Dorado County:			
Lilyama	C. W. Colgrove	6305 Yucca St., Hollywood 28	Pilot Hill
Humboldt County:			
Copper Bluff	Providence Tuolumne Gold Mines, Inc.	1686 Union St., San Francisco	Hoopa
Inyo County:			
Darwin group	The Anaconda Co.	P. O. Box 58, Darwin	Darwin
Pine Creek	Union Carbide Nuclear Co., Division of Union Carbide Corp.	Room 2115-30, E. 42d St., New York 17	Bishop
Santa Rosa	Thomas D. Norris	P. O. Box 111, Keeler	Keeler
Valley View Copper	R. W. McAllister	5131½ Sunset Blvd., Hollywood 27	Ubehebe
Madera County:			
Jesse Bell	Multi-Metals, Inc.	440 Blackstone Ave., Fresno	Daulton

* Principal copper producers (not less than 10,000 pounds).

Diatomite (Diatomaceous Earth)

Operator	Address	Location
Los Angeles County:		
Great Lakes Carbon Corp., Dicalite Division	612 S. Flower St., Los Angeles 17	Palos Verdes
Napa County:		
Basalt Rock Co., Ltd.	Eighth and River Sts., Napa	Napa
Santa Barbara County:		
Airox Company	307 W. Eighth St., Los Angeles 14	Casmalia
Great Lakes Carbon Corp., Dicalite Division	612 S. Flower St., Los Angeles 17	Lompoc
Johns-Manville Products Corp.	22 E. 40th St., New York, N. Y.	Lompoc

Feldspar

Operator	Address	Location
Monterey County:		
Del Monte Properties Co.	P.O. Box 150, Pacific Grove	Pacific Grove
Owens-Illinois	P.O. Box 1035, Toledo 1, Ohio	Pacific Grove
San Bernardino County:		
Gladding, McBean & Co.	2901 Los Feliz Blvd., Los Angeles 39	Atolia

Fluorspar

Operator	Address	Location
San Bernardino County:		
Pacific Fluorite Co.	Valley Wells, via Nipton	Nipton

Gold *

Mine	Type of mine**	Operator	Address	Location of mine
El Dorado:				
Hazel Creek	a	Hazel Creek Mining Corp.	P.O. Box 3508, North Sacramento	Sly Park
Fresno:				
Rockfield gravel plant	g	Kerkling and Slensker	1800 Dover St., Lakewood, Colorado	Friant
Humboldt County:				
Copper Bluff	i	Providence Tuolumne Gold Mines, Inc.	1686 Union St., San Francisco	Hoopa
Inyo County:				
Darwin group	l	The Anaconda Co.	P.O. Box 58, Darwin	Darwin
Pine Creek	t	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	Rm. 2115-30 E. 42d St., New York 17, N. Y.	Eishop
Kern County:				
Yellow Aster	a	4-D Mining Co.	c/o Wm. Stryker, Johannesburg	Johannesburg
Yellow Aster	a	Wm. A. Stryker and Louis E. Harral	P.O. Box 264, Johannesburg	Johannesburg
Los Angeles County:				
Azusa Gravel Plant	g	San Gabriel Valley Placers	1237 S. Greenwood Ave., Montebello	Montebello
Consolidated Rock Products	g	Consolidated Rock Products Co.	P.O. Box 2950, Terminal Annex, Los Angeles	Azusa
Mariposa County:				
Red Bank	a	Chris Mills	c/o Bagley Store, Mariposa	Coulterville
Nevada County:				
Brunswick	c	Idaho Maryland Mines Corp.	P.O. Box 1028, Grass Valley	Grass Valley
Empire North Star group	c	Empire Star Mines Corp.†	P.O. Box 1027, Grass Valley	Grass Valley
Empire North Star group	c	New Verde Mines Co.†	P.O. Box 1027, Grass Valley	Grass Valley
Little Fort Knox	a	Jack Sutherland	P.O. Box 919, Grass Valley	Grass Valley
Sacramento County:				
Higgins Gravel Pit	g	Mrs. C. M. Craig	2457 Portola Way, Sacramento	Mills
Natomas	b	Natomas Co.	P.O. Box 1197, Sacramento	Folsom
Perkins Gravel Pit	g	Macklin Mining Co.	P.O. Box 535, West Sacramento	Perkins
Shasta County:				
Oscar Davis property	d	Roy S. Olson	1178 Walnut Ave., Redding	Redding
Sierra County:				
Brush Creek	a	Best Mines Co., Inc.	P.O. Box 177, Downieville	Downieville
Gold Crown	a	Gold Crown Mining Corp.	Alleghany	Alleghany
Original 16 to 1	a	Original 16 to 1 Mine, Inc.	235 Montgomery St., San Francisco	Alleghany

Siskiyou County:				
Haydon	d	Scott River Dredging Co.	625 Market St., San Francisco 5	Callahan
Siskon	a	Siskon Corp.	Box 148, Happy Camp	Happy Camp
Trinity County:				
Fairview Placer	b	Fairview Placers	Lewiston	Minersville
Yuba County:				
Browns Valley group	a	C. C. Butler and M. R. Smethurst	Browns Valley	Browns Valley
Yuba Unit	b	Yuba Consolidated Gold Fields, Div. Yuba Consolidated Industries, Inc.	351 California St., San Francisco	Hammonton
	h	Keith Gear	460 River Rd., Yuba City	Marysville

* Of 171 gold producers, only producers of 100 ounces or more are listed here.
** a, Lode gold mine; b, Bucket line dredge; c, Cleanup, final; d, Dragline dredge; g, Gravel plant; h, Sluicing hand methods; i, Copper-gold mine; j, Non-floating washing plant; l, Lead-zinc mine; t, Tungsten mine.
† On May 6, 1957, the New Verde Mines Co. took over the management of the Empire Star Mines.

Granite (Dimension Stone)

Operator	Address	Location
Fresno County:		
Superior Academy Granite Co.	P.O. Box 68, Clovis	Academy
Lassen County:		
Susanville Marble and Granite Works	918 Nevada St., Susanville	Susanville
Madera County:		
Raymond Granite Co.	Raymond	Raymond
Placer County:		
Union Granite	P.O. Box 819, Rocklin	Rocklin
San Bernardino County:		
Bella Vista Stone Supply	8966 E. Huntington Dr., San Gabriel	San Gabriel
Lucerne Valley Engineering Co.	P.O. Box 605, Victorville	Lucerne
San Diego County:		
W. T. Blackwood and Sons	243 E. Fifth St., Escondido	Escondido
Clement Granite Co.	3600 Suncrest Blvd., El Cajon	Suncrest
Escondido Quarries, Inc.	530 W. Sixth St., Los Angeles	Escondido
National Quarries	923 Park Hill Dr., Escondido	Escondido
Snorey, T. J.	4239 Arizona St., San Diego	San Diego

Gypsum

Operator	Address	Location
Alameda County:		
Fibreboard Paper Products Corp.*	475 Brannan St., San Francisco	Newark
Westvaco Mineral Products Division, Food Machinery & Chemical Corp.*	P.O. Box 337, Newark	Newark
Imperial County:		
United States Gypsum Co.	300 W. Adams St., Chicago, Ill.	Plaster City
Kern County:		
Antelope Valley Agricultural Gypsum Co.	P.O. Box 535, Rosamond	Cantil
Agricultural Gypsum Mine, C. L. Fannin	Rt. 1, Box 7, Wasco	Wasco
H. M. Holloway	714 Sixth St., Wasco	Lost Hills
Lansdon Mining Co.		Maricopa
Mel Northington	1122 Castaic Ave., Oildale	Belridge
Superior Gypsum Co.	3916 Pierce Rd., Bakersfield	Lost Hills
Temblor Gypsum Co.	Sta. Rt. Box 80, Santa Margarita	Carrizo Plains
Kings County:		
McPhaill Gypsum Co.	P.O. Box 927, Visalia	Avenal
Merced County:		
Agricultural Mineral & Fertilizer Co., A. D. Sousa	P.O. Box 832, Los Banos	Los Banos
Riverside County:		
United States Gypsum Co.	300 W. Adams St., Chicago 6, Ill.	Midland
San Luis Obispo County:		
Superior Gypsum Co.	3916 Pierce Rd., Bakersfield	Carrizo Plains
Ventura County:		
Monolith Portland Cement Co.	Box 65947, Glassell Sta., Los Angeles 65	Quatal Canyon

* Output not included in production figures, as gypsum is by-product of chemical process using minerals already included in state total.

Iodine

Operator	Address	Location
Los Angeles and Orange Counties:		
Deepwater Chemical Co., Ltd.	Box 588, Compton	Compton
Western Division, The Dow Chemical Company	P.O. Box 245, Seal Beach	Long Beach, Venice, and Seal Beach

Iron

Mine	Operator	Address	Location
Riverside County:			
Eagle Mountain	Kaiser Steel Corp.	Box 217, Fontana	Desert Center
San Bernardino County:			
Bessemer	Kaiser Steel Corp.	Box 217, Fontana	Lavic
Bradley and Horn	Bradley and Horn	Twentynine Palms	--
Iron Age	Iron Age Mines Co.	Twentynine Palms	Amboy
Cave Canyon	Mineral Materials Co.	1145 Westminster Ave., Alhambra	Baxter

Lead *

Mine	Operator	Address	Post office of mine
El Dorado County:			
Hazel Creek	Hazel Creek Mining Corp.	P. O. Box 3508, North Sacramento	Sly Park
Inyo County:			
Darwin group	The Anaconda Co.	P. O. Box 58, Darwin	Darwin
Defense	Forman and Forman	P. O. Box 175, Darwin	Panamint Springs
Minnietta	Austin Choppe and Robert H. Allsop	P. O. Box 5, Trona	Panamint Springs
Ophir	Ned Raymond	P. O. Box 1071, Trona	Trona
Santa Rosa	Thomas D. Norris	P. O. Box 111, Keeler	Big Pine
Shoshone group	The Anaconda Co.	P. O. Box 58. Darwin	Shoshone
White Mountain Lead	Richard Horne	Bishop	White Mountain
Silver Spoon	R. C. Finley	P. O. Box 657, Lone Pine	Darwin
Mono County:			
Topaz Lead & Silver	Metallurgical Development Co.	P. O. Box 101, Gardnerville, Nevada	--
San Bernardino County:			
Silver Prince	E. J. McClellan et al.	P. O. Box 784, Big Bear Lake	Big Bear Lake

* Principal producers only (production not less than 10,000 pounds).

Lime, Limestone,* Dolomite, and Shells

Name	Type of mine	Address	Location
El Dorado County:			
California Rock & Gravel Co.	a, f	1800 Hobart Bldg., San Francisco	Cool
Diamond Springs Lime Co.	a, b, f	Box 409, Diamond Springs	Diamond Springs
El Dorado Lime Co.	a, f	Shingle Springs	Shingle Springs
Inyo County:			
Marble Sales Corp.	d	728 E. 59th St., Los Angeles 3	Lone Pine
George Metcalf	d	Rt. 1, Box 601, Sonora	----
West End Chemical Co., Div. of Stauffer Chemical Co.	a	1946 Webster St., Oakland 12	West End
Monterey County:			
Kaiser Aluminum & Chemical Corp.	b, c	Box 1531, Salinas	Natividad

Riverside County:			
W. E. Kier Construction Co.	f	2323 E. Rosecrans Ave., El Segundo	----
Snotop Rock Products	d	27th St., Riverside	West Riverside
San Benito County:			
Westvaco Mineral Products, Div. of Food Machinery & Chemical Corp.	c	P.O. Box 337, Newark	Hollister
San Bernardino County:			
Bella Vista Stone Supply	e	8966 E. Huntington Dr., San Gabriel	Little Creek
California Dolomite Co., Inc.	c	17619 S. Clark, Bellflower	Kramer
California Portland Cement Co.	a, b	612 S. Flower St., Los Angeles	Colton
Fourth Street Rock Crusher	d	1945 Fourth St., San Bernardino	San Bernardino
Industrial Roofing Rock Co.	d	Camp Ono, San Bernardino	----
Sweetser, N. W.	d	P.O. Box 445, Rosamond	----
Victorville Lime Rock Co.	a, g	Box 548, Victorville	Victorville
West End Chemical Co., Div. of Stauffer Chemical Co.	b	1946 Webster St., Oakland	West End
San Luis Obispo County:			
Eaton and Smith	a	1215 Michigan Ave., San Francisco	Lime Mountain
San Mateo County:			
Mark Materials, Inc.	f	P.O. Box 806, Belmont	Rockaway Beach
Pioneer Shell Co.	g, h	100 E. "D" St., Petaluma	----
Skyline Materials Co.	f	P.O. Box 806, Belmont	Belmont
South Bay Dredging Co.	g, h	Rt. 1, Box 894, Santa Clara	San Francisco Bay
Santa Clara County:			
Bahr & Ledoyen, Inc.	f	3291 Park Blvd., Palo Alto	Los Altos
Bay Shell Co.	a, h	Santa Clara-Alviso Rd., Santa Clara	----
Permanente Cement Co.	f	1924 Broadway, Oakland	Los Altos
South Bay Dredging Co.	g, h	Rt. 1, Box 894, Santa Clara	Palo Alto
Santa Cruz County:			
Pacific Cement & Aggregates, Inc.	a, d	400 Alabama St., San Francisco	Davenport
Pacific Limestone Products Co.	a, g	P.O. Box 468, Santa Cruz	Santa Cruz
Tuolumne County:			
Sonora Marble Aggregate Co.	a, d, g	Rt. 1, Box 599, Sonora	Shaws Flat
U. S. Lime Products	a, b, g	175 S. Alvarado St., Los Angeles	Sonora, Columbia
Ventura County:			
Western Lime Products	a	520 Mission St., South Pasadena	Santa Susana

* Limestone other than that used in cement: a, Limestone; b, Lime; c, Dolomite; d, Marble used in roofing and terrazzo granules; e, Limestone used as building stone; f, Crushed limestone for riprap and aggregate; g, Agricultural limestone; h, Shells.

Lithia

Operator	Address	Location
San Bernardino County:		
American Potash & Chemical Corp.	3030 W. Sixth St., Los Angeles 54	Trona

Magnesia and Other Magnesium Compounds

Operator	Address	Location
Alameda County:		
Westvaco Mineral Products Division, Food Machinery & Chemical Corp.	P.O. Box 337, Newark	Newark
Monterey County:		
Kaiser Aluminum & Chemical Corp. (oxide)	Box 1531, Salinas	Moss Landing
San Diego County:		
Westvaco Mineral Products Division, Food Machinery & Chemical Corp.	P.O. Box 337, Newark	Chula Vista
San Mateo County:		
Marine Magnesia Products Division, Merck & Co. (carbonate, hydroxide, and oxide)	E. Grand Ave., South San Francisco	South San Francisco

Magnesite

Operator	Address	Location
Santa Clara County:		
James McPeters	Star Route, Box 39, Livermore	Red Mountain

Mine	Operator	Address	Location
Imperial County:			
Alaskan claim	Walter S. Thing	2916 Heather Ave., Redding	Palo Verde
Black Beauty	Walter S. Thing	2916 Heather Ave., Redding	Palo Verde
Pioneer	Holken Mining Co.	P. O. Box 308, Winterhaven	Blythe
Pioneer	Gene De Zan		Blythe
Inyo County:			
Wingate group	Wingate Manganese Co.	1682 Chester Ave., Bakersfield	Shoshone
Plumas County:			
Mt. Hough	Wm. L. Ash	646 Second St., Colusa	Quincy
Riverside County:			
Arlington group	Alfred Figueroa	Box 453, Blythe	Blythe
Arlington & Langdon & Kyle group	California Limestone Products	139 S. Beverly Dr., Beverly Hills	Blythe
San Bernardino County:			
Owl's Head	Owl Spring Co., Inc.	2001 W. Artesia Blvd., Torrance	Baker
San Luis Obispo:			
Johe Ranch	Porter L. Jackman and Bob Biachini	Rt. 1, Box 161B, San Luis Obispo	--

Mercury (Quicksilver)*

Mine	Operator	Address	Location of mine
Colusa County:			
Ukiah	Ukiah Mines Inc.	Ukiah	--
Fresno County:			
Esperanza	Leonard W. Knepper	P. O. Box 67, Idria	Idria
Kings County:			
Dawson	Electronic Mineral & Development Co.	Box 269, Santa Clara	Parkfield
Fredana	Roy Pierce and C. J. Peterson	124 Atkinson Lane, Watsonville	Parkfield
Lake County:			
Abbott	California Quicksilver Mines, Inc.	General Delivery, Williams	Wilbur Springs
Baker	Louis J. Rice	900 Victor St., Lodi	Lower Lake
Sulphur Bank	Bradley Mining Co.	660 Market St., San Francisco	Clear Lake
Wall Street	Liquid Metal Oil & Gas Co.	Middletown	Middletown

Mercury (Quicksilver)*—Continued

Mine	Operator	Address	Location of mine
Marin County:			
Edwards Bros.	Panco Mining Corp.	5813 Fremont St., Oakland	Marshall
Gambonini	E. Turner	2005 West Ave., Petaluma	Marshall
Monterey County:			
Patriquin	Apex Engineering	311 Park St., Paso Robles	Parkfield
Napa County:			
James Creek	W. L. Graham	2702 Stoney Point, Petaluma	Pope Valley
James Creek	James Creek Placer Co.	2034 Imola Ave., Napa	Pope Valley
Oat Hill	W. T. Kritikas and H. W. Magorian	3118 W. Euclid, Stockton	Aetna Springs
Oat Hill	Vincent Yracabel	P. O. Box 17, Middletown	Aetna Springs
San Benito County:			
Aurora	E. P. Jarrett	11694 Sheldon, Sun Valley	Idria
Aurora	Leonard W. Knepper	P. O. Box 67, Idria	Idria
Dar	Donald Sciocchetti	P. O. Box 637, Hollister	Paicines
El Cajon	Matthews Mining Co.	135 Fine St., Hollister	Panoche
Florence Mac	Electronic Minerals & Development Co.	Box 269, Santa Clara	Hernandez
C & J	C & J Mine	19450 Almaden Rd., San Jose	Hollister
Mathews	Leonard W. Knepper	P. O. Box 67, Idria	Panoche
New Idria	New Idria Mining & Chemical Co.	P. O. Box 87, Idria	Idria
Nona No. 1	Nona Mining Co.	Hernandez St., San Benito	Hernandez
San Carlos	Leonard W. Knepper	P. O. Box 67, Idria	Idria
Santa Margarita	Juan Carrillo, Jr. et al.	Bitterwater Rd., King City	Hernandez
Turkey Hill	R. A. Fontes	930 E. First St., Livermore	Paicines
Wonder	Robert L. Lee	708 Francis St., Seaside	Idria
San Luis Obispo County:			
Buena Vista	Harold Biaggini	Box 233, Templeton	Adelaida
Klau	J. Errol Dodd	Adelaida Route, Paso Robles	Adelaida
La Libertad	Heavy Metals Co., Inc.	926 Alma St., Glendale	Adelaida
Oceanic	Frank Vollmar	P. O. Box 281, Cambria	Cambria
Polar Star	Kenneth Emigh	Soquel and Front Sts., Santa Cruz	San Simeon
Senator	Woodrow Osborne and W. R. Billings	P. O. Box 208, Templeton	Adelaida
San Mateo County:			
Challenge (Emerald Lake)	Challenge Mining Co.	727 Shasta St., Redwood City	Redwood City

Santa Barbara County:			
Gibraltar	Gibraltar Mining Co.	15518 Lakewood Blvd., Paramount	Santa Barbara
Santa Clara County:			
Guadalupe	Palo Alto Mining Corp.	14900 Coleman Rd., San Jose	Los Gatos
New Almaden mine	Mrs. Henry Austin	Almaden	Almaden
	Andrew and Sam Balderama	Almaden	Almaden
	Bylerly and Thompson	Box 252, Rt. 2, Morgan Hill	Almaden
	Cameron and Thrasher	c/o Almaden Mining Properties, Almaden	Almaden
	E. B. Carlton	Almaden	Almaden
	Crystal Ball Mining Co.	21660 Bartron Rd., San Jose	Almaden
New Almaden mine	M. Tarsa	Almaden	Almaden
	Gish Brothers	455 S. 12th St., San Jose	Almaden
	Edgar T. Haun	531 E. Williams St., San Jose	Almaden
	Harold Hughes	Rt. 1, Box 176, San Martin	Almaden
	K. & P. Mining	P.O. Box 91, San Jose	Almaden
	Fred Kafka and Dan Austin	Almaden	Almaden
	George Kirk	16268 San Jose Rd., Los Gatos	Almaden
	Francisco Marrujo	c/o New Almaden Mine, Almaden	Almaden
	Harry Mobley	Rt. 1, Box 174, San Martin	Almaden
	New Almaden Mine	Almaden	Almaden
	Frank Pfeiffer	18931 Graystone Lane, Los Gatos	Almaden
	Lorenzo Ramirez	c/o New Almaden Mine, Almaden	Almaden
	M. C. Showalter	21187 Almaden Rd., San Jose	Almaden
	George Staffers and Morris Turner	Almaden	Almaden
	L. Stotesberry	19251 Almaden Rd., San Jose	Almaden
	Thrasher and Steidley	Almaden	Almaden
	V & W Mining Co.	Almaden	Almaden
Sonoma County:			
Buckman	Buckman Mines, Mineral Div. of Buckman Laboratories, Inc.	1256 N. McLean Blvd., Memphis 8, Tenn.	Cloverdale
Mercury Bank	Mercury Bank	P.O. Box 153, Healdsburg	Healdsburg
Mt. Jackson	Sonoma Quicksilver Mines, Inc.	P.O. Box 226, Guerneville	Guerneville
Socrates	A. E. Blackner & Assoc.	328 Carrillo St., Santa Rosa	Pine Flat
Trinity County:			
Altoona	Austin and Smith	983 Mills Bldg., San Francisco	Trinity Center

* Excluding names of a few small mines for which no data were available other than those obtained from purchasers.

Mica

Operator	Address	Location
Imperial County:		
R. K. Foster	P.O. Box 575, Winterhaven	Ogilby
Imperial Milling Co.	2738 Merced Ave., El Monte	Ogilby

Molybdenum

Mine	Operator	Address	Location
Inyo County:			
Pine Creek	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	30 E. 42d St., New York 17, N. Y. Attn. W. E. Smith	Bishop

Peat

Operator	Address	Location
Contra Costa County:		
Delta Dredging Co.	Rt. 1, Box 894, Santa Clara	Brentwood
Vita Peat, Inc.	P.O. Box 255, Bethel Island	Bethel Island
Modoc County:		
Modoc Peat Moss Co.	604 Mission St., San Francisco 5	Likely
Orange County:		
R. W. McClellan and Sons	151 Commercial Way, Costa Mesa	Costa Mesa
Peat Sales Co., D. M. Callis, Jr.	17581 Gothard Rd., Huntington Beach	Huntington Beach

Perlite

Operator	Address	Location
Contra Costa County:		
Kaiser Gypsum Co., Inc. (expanded)	1924 Broadway, Oakland 12	Antioch
Fresno County:		
Perlite Products (expanded) Triestsch & Clark Inc.	93 Van Ness Ave., Fresno	Fresno
Inyo County:		
International Minerals & Chemical Corp. (crude)	3107 S. La Cienega Blvd., Los Angeles 16	Fish Springs
Los Angeles County:		
International Minerals and Chemical Corp. (expanded)	3107 S. La Cienega Blvd., Los Angeles 16	Los Angeles
Kaiser Gypsum Co., Inc. Long Beach Hill (expanded)	1924 Broadway, Oakland	Long Beach
Marcus A. McClure Co. (expanded)	35 N. Raymond Ave., Pasadena 1	Los Angeles
Panacalite Pacific, Inc. (expanded)	825 E. 60th St., Los Angeles 1	Los Angeles
Paramount Perlite Co., Inc. (expanded)	16236 S. Illinois, Paramount (P.O. Box 83)	Paramount
Perlite Popped Products (expanded)	12655 E. Imperial Highway, Norwalk	Norwalk
Redco, Inc. (expanded)	11831 Vose St., North Hollywood	North Hollywood
Marin County:		
Perolite Products Corp. (expanded)	P.O. Box 175, Sausalito	Sausalito
Napa County:		
Perlite Aggregates, Inc. (crude and expanded)	P.O. Box 3, Sta. A., Berkeley 2	St. Helena
Riverside County:		
More-Lite Co. (expanded)	R.F.D. 5, Box 101-B, Crestmore via Riverside	Crestmore
San Bernardino County:		
California Perlite Corp. (crude)	35 N. Raymond Ave., R 228, Pasadena 1	Ludlow
San Diego County:		
Harborlite Corp. (expanded)	P.O. Box 458, Escondido	Chula Vista

Platinum Group Metals

Operator	Address	Location
Sacramento County:		
Natomas Company	Box 1197, Sacramento	Folsom
Yuba County:		
Yuba Consolidated Gold Fields	351 California St., San Francisco	Hammonton

Potash

Operator	Address	Location
Contra Costa County:		
A. M. Blumer	465 California St., San Francisco	Cowell
San Bernardino County:		
American Potash and Chemical Corp.	3030 W. Sixth St., Los Angeles 54	Trona
Santa Cruz County:		
A. M. Blumer	465 California St., San Francisco	Davenport

Pumice and Pumicite

Mine	Operator	Address	Location
Fresno County:			
South Dome	Fresno Pumi-Tile Co.	1508 Thesta St., Fresno	Friant
Imperial County:			
Superlite Building Supply	Superlite Builders Supply Co.	P.O. Box BB, or 758 Calipatria	Calipatria
Inyo County:			
Crownite Corp.	Crownite Corp.	6363 Wilshire Blvd., Los Angeles 48	Coso Junction
Red-lite Aggregate	Red-lite Aggregate, Ltd.	111 N. La Cienga Blvd., Beverly Hills	Little Lake
Coso	Paul R. Splane	490 S. San Vincenta, Los Angeles 48	Little Lake
Van Loon	Transmix Corp.	3464 E. Foothill Blvd., Pasadena 8	Bishop

Kern County:			
Calsilco claims	Calsilco Corp.	5201 Alhambra Ave., Los Angeles 32	Inyokern
Lake County:			
V. V. Coleman	V. V. Coleman	Lower Lake	Clearlake Highlands
Volcanic ash pit	Rodger E. Hellgren	P.O. Box 420, Clearlake Highlands	Clearlake Highlands
Lassen County:			
Mt. Lassen Cinder Co.	Mt. Lassen Cinder Co.	903 Cottage St., Susanville	Susanville
Madera County:			
Taylors	California Industrial Minerals Co.	P.O. Box 188, Friant	Friant
Elmer Erickson	Elmer Erickson	Box 98, Friant	Friant
Ol' Rebel	Ol' Rebel Minerals, Inc.	140 Harvard St., Fresno 5	Friant
Modoc County:			
Ainshea Butte	Great Northern Railway	175 E. Fourth St., St. Paul, Minn.	Mammoth (Tionesta)
Tulelake Mill	U. S. Pumice Supply Co.	6331 Hollywood Blvd., Los Angeles 28	Newell
Mono County:			
Cowan & McGraw	Cowan and McGraw	P.O. Box 1013, Bishop	Benton
	Bishop Engineering Co.		
Insulating Aggregates	Andrew Boyd	Box 572, Bishop	Bishop
Leevining Mill	U. S. Pumice Supply Co.	6331 Hollywood Blvd., Los Angeles 28	Leevining
San Bernardino County:			
Pisgah	Atkinson Topeka & Santa Fe	General Office Bldg., Topeka, Kansas	Ludlow
Farway	Harry F. Heather	236 S. Oak Knoll Ave., Pasadena 5	Amboy
Kleen-Cyo	John Rerese	P.O. Box 1048, Palm Springs	Hinkley
Shasta County:			
	California Div. Highways		
H. H. Ranch	Harry and Ivy Horr	Horr's H. H., Ranch, Glenburn	Glenburn
Blue Sage	Bert C. Peeler	P.O. Box 131, McArthur	McArthur
Red Butte	Bert C. Peeler	P.O. Box 131, McArthur	McArthur
Siskiyou County:			
	California Div. Highways		
Free, H. P.	Herman P. Free	Tionesta	Tulelake
	Lava Bed National Monument	National Park Service, Region IV, Tulelake	Tulelake
Glass Mountain (Skoria Star)	John Madsen	P.O. Box 711, Klamath Falls, Oregon	Tionesta
Porcupine pit	McCloud River Lumber Co.	McCloud	Hambone
Shastalite	Shastalite Cinder Block Co.	300 N. Main St., Yreka	Yreka
Kegg cinder pit	Southern Pacific Co.	65 Market St., San Francisco	Kegg (Tionesta)
Thompson Pumice	Thompson Pumice Co.	Star Route, Box 10, Tulelake	Tulelake

Pyrite

Operator	Address	Location
Shasta County:		
The Mountain Copper Co., Ltd., L. T. T. Kett, Jr., Mgr.	230 California St., San Francisco 4	Matheson

Rare Earth Minerals

Operator	Address	Location
San Bernardino County:		
Molybdenum Corp. of America	500 Fifth Ave., New York, N. Y.	Mountain Pass

Operator	Address	Location
Alameda County:		
American Salt Co.	341 Broadway, San Francisco 11	Mt. Eden
Leslie Salt Co.	505 Beach St., San Francisco 11	Newark & Mt. Eden
Morton Salt Co.	120 S. La Salle St., Chicago, Ill.	Newark
Oliver Bros. Salt Co.	P.O. Box 132, Mt. Eden	Mt. Eden
Kern County:		
Long Beach Salt Co.	2476 Hunter St., Los Angeles 21	Saltdale
Monterey County:		
Monterey Bay Salt Works, E. C. Vierra, Mgr.	Box 43A, Moss Landing	Moss Landing
Orange County:		
Western Salt Co.	P.O. Box 149, San Diego 12	Newport Beach
San Bernardino County:		
California Salt Co.	2436 Hunter St., Los Angeles 21	Amboy
Metropolitan Water District of Southern California	306 W. Third St., Los Angeles 13	Rice
Pacific Salt & Chemical Co.	P.O. Box 9128, Sta. S, Los Angeles 5	Trona
San Diego County:		
Western Salt Co.	P.O. Box 149, San Diego 12	Chula Vista
San Mateo County:		
Leslie Salt Co.	505 Beach St., San Francisco 11	Redwood City

Sand, Gravel, and Miscellaneous Stone †

Operator	Product*	Address	Location
Alameda County:			
Bell's Sand & Gravel Co.	sg	P.O. Box 282, Irvington	Irvington
California Rock & Gravel Co.	sg	1800 Hobart Bldg., San Francisco	Livermore
Castro Valley Rock Co.	cr	20450 John St., Hayward	Castro Valley
Corri Bros., Inc.	cr	28806 Castro St., Hayward	--
Concrete Service Co.	sg	860 Sunol St., San Jose	Sunol
Deetz Sand & Gravel Co.	sg	743 Pleasanton Ave., Pleasanton	Niles
Escabar quarry	cr	2886 Castro St., Hayward	Mission San Jose
Gallagher & Burk, Inc.	cr	344 High St., Oakland	Oakland
Goddard Bros.	cr	187 Sunset Blvd., Hayward	Hayward
Henry J. Kaiser Co.	sg	Kaiser Bldg., 1924 Broadway, Oakland 10	Niles, Radum
Niles Quarry Co.	cr, fr	Box 507A, 4061 Highland Blvd., Niles	Niles
Niles Sand & Gravel Co.	sg	P.O. Box 165, Niles	Niles
Pacific Cement & Aggregates, Inc.	sg, cr	400 Alabama St., San Francisco 10	Eliot, Fremont, Niles
Rhodes & Jamieson, Ltd.	sg	333 23d Ave., Oakland 4	Fremont
San Leandro Rock Co.	cr	1575 Chabot Rd., San Leandro	San Leandro
H. C. Thompson Sand Dredging Co.	s	P.O. Box 403, Alameda	Alameda
A. C. Zaro gravel pit	sg	301 Augustine St., Pleasanton	Pleasanton
Amador County:			
Decorock, Inc.	cr	Russ Bldg., San Francisco	Lancha Plana
Ione Clay & Sand Co.	s	P.O. Box 25, Ione	Ione
Owens-Illinois Glass Co.	gs	P.O. Box 1035, Toledo 1, Ohio	Ione
Butte County:			
Butte Creek Rock Co.	sg	P.O. Box 512, Chico	Chico
Farr Bros.	sg	P.O. Box 146, Gridley	Gridley
Feather River Aggregates	cr	2920 Barnes Way, Oroville	Oroville
Henry J. Kaiser Co.	sg	Kaiser Bldg., 1924 Broadway, Oakland 10	Oroville
Marler & Sons Rock Co.	sg	4640 Virginia Ave., Oroville	Oroville
Mastellotto, A. J.	sg	136 Canyon Highway Dr., Oroville	Gridley
Matthews Readymix, Inc.	sg	Rt. 1, Box 23, Gridley	Gridley
Oroville Rock & Sand Co.	sg	Marysville Rd., Oroville	Oroville
Pentz Gravel	sg	Durham	Durham
Perry and Rowe	sg	P.O. Box 297, Live Oak	Biggs
Teichert Aggregate Co.	cr, sg	Verbena Ave. and E. First St., Chico	Chico
Calaveras County:			
Jupiter Lumber Co.	sg	Sonora	Vallecito
Nielsen Sand & Gravel Co.	sg	P.O. Box 457, San Andreas	Mokelumne Hill
Pacific Clay Products Co.	gs	1255 W. Fourth St., Los Angeles	Camanche

Colusa County:			
Cortina Rock, Sand, & Gravel Co., c/o Gene Godon	sg	P.O. Box 357, Colusa	Colusa
Contra Costa County:			
Blake Bros.	cr	P.O. Box 1002, Richmond	Richmond
Don Bruce	cr	c/o Camp Herns, 1290 Arlington, El Cerrito	El Cerrito
Gallagher & Burk, Inc.	cr	344 High St., Oakland	Walnut Creek
Henry J. Kaiser Co.	cr	Kaiser Bldg., 1924 Broadway, Oakland 10	Clayton
Charles Law	sg	585 Risdon Rd., Concord	Cowell
Marchio Silica Co.	s, fs	Rt. 1, Box 1386, Antioch	Antioch
Morris Sand Pit, Ben Morris	s	Rt. 1, Box 659, Antioch	Antioch
Mt. Diablo Rock & Aggregate Co.	cr	4137 Nulty Dr., Concord	Concord
Pacific Cement & Aggregates, Inc.	cr	400 Alabama St., San Francisco 10	Clayton
Serra Bros.	cr	R.F.D. 1, Box 355, Martinez	Pacheco
Silver Sand Co.	s	P.O. Box 5, Cowell	Cowell
Tunnel Rock Co.	cr	220 Tunnel Rd., Orinda	Orinda
Wills, Fay	s	Rt. 1, Box 233, Antioch	Antioch
Del Norte County:			
Endert, Fred	cr	1182 Eighth St., Crescent City	Crescent City
Peter Kiewit Sons Co.	cr	P.O. Box 1777, Vancouver, Wash.	--
Pelican Bay Construction Service, Inc.	sg	Smith River	Smith River
Simpson Redwood Co.	sg	Box A, Klamath	Klamath
El Dorado County:			
Anderson, Bertel	s	Tahoe City	Lake Tahoe
California Rock & Gravel Co.	cr	1800 Hobart Bldg., San Francisco 4	Cool
Cold Springs Sand & Gravel Co.	sg	57 Coloma St., Placerville	Placerville
Diamond Springs Lime Co.	cr	P.O. Box 409, Diamond Springs	Diamond Springs
El Dorado Limestone Co.	cr	Shingle Springs	Shingle Springs
Sierra Placerite Corp.	rg	Rt. 3, Box 252, Placerville	Placerville
White, J. T., contractors	sg	P.O. Box 24, Lake Tahoe	Lake Tahoe
Fresno County:			
Anderson Rock Products	sg	Old Lanesbridge, Fresno	Friant
Atchison, Topeka & Santa Fe	cr	121 E. Sixth St., Los Angeles	--
Central Rock & Sand Co.	sg	P.O. Box 425, Sanger	Sanger
Folsom, L. D.	sg, cr	P.O. Box 347, Coalinga	Coalinga
Harms Bros.	sg	5261 Stockton Blvd., Sacramento	--
Herndon Rock Products Co.	sg	410 Thorn St., P.O. Box 886, Fresno 14	Fresno
Kings River Construction Co.	sg	P.O. Box 827, Fresno	Kings River
Morrison-Knudsen Co., Inc.	sg	411 W. Fifth St., Los Angeles	Wishon Dam
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Rockfield, Friant
Richardson, Roy	sg	355 Thorn Ave., Fresno	Panoche Creek
C. E. Roberts & Son	sg	W. Elm St., Coalinga	Coalinga
Sanger Rock & Sand	sg	17125 Kings Canyon Rd., Sanger	Sanger
Thompson Materials & Construction Co., Inc.	sg	917 Dome St., Avenal	Coalinga
Volpa Bros.	sg	233 Nielsen St., Fresno	--

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Glenn County:			
Dunlap, Wm.	sg	County Rd., M. M. Willows	--
Estes, E. B.	sg	Princeton	Princeton
Orland Sand & Gravel Co.	sg	P.O. Box 916, Orland	Wyo
Reager, Frank	sg	Glenn	Glenn
Southern Pacific Co.	sg	65 Market St., San Francisco	Wyo
Humboldt County:			
J. J. Ely Co.	sg	P.O. Box 834, Larkspur	--
Eureka Sand & Gravel Co.	sg	1955 Hittiker Ave., Eureka	Eureka
Hull, Tom	sg	930 Carson St., Eureka	Blue Lake
John R. Lovett Co.	sg	P.O. Box 23, Hydesville	--
Manley, Jesse	sg	11 E. 11th St., Arcata	Gravel Bay
McWhorter & Dougherty	sg, b	P.O. Box 542, Fortuna	Fortuna
Imperial County:			
Alberta, Henry	sg, dg	1268 El Dorado, El Centro	Brawley
Farmers Gravel Co.	sg	18404 Gothard St., Huntington Beach	Westmorland
Gibson, H. C.	sg	Box 1278, Brawley	Brawley
Janney Sand & Gravel	sg	1886 Walnut St., Yuma, Arizona	Winterhaven
McElvany, J. L.	sg	P.O. Box 818, El Centro	El Centro
Navajo Rock Co., Don M. Weaver	cr	Jacumba	Jacumba
J. B. Nelson gravel pit	sg	Holtville	Holtville
P. T. Pinner & Son	sg	P.O. Box 115, Brawley	Brawley
Valley Transit Cement Co.	sg	P.O. Box 1489, El Centro	Brawley
Inyo County:			
Bishop Engineering & Construction Co.	sg	P.O. Box 505, Bishop	Bishop
Gladding, McBean & Co.	g	2901 Los Feliz Blvd., Los Angeles	--
Hiatt's Sand & Gravel Co.	sg	362 Clarke St., Bishop	Bishop
Kern County:			
Desert Rock Milling Co.	rg	650 Clover, Los Angeles	--
Dicco, Inc.	sg	Bin 217, Sta. A, Bakersfield	Bakersfield
Edison Sand Co.	s	118 34th St., Bakersfield	Bakersfield
Griffith Co.	cr	Box 175, Sta. B, Bakersfield	Bakersfield
Groover Mining & Milling Co.	rg	11620 Laurel Crest Dr., Studio City	--
Grossardt, Willis B.	sg	430 Robertson Rd., Ridgecrest	Inyokern
Hartman Concrete Materials Co.	sg	P.O. Box 1632, Bakersfield	Bakersfield, Maricopa
Kern River Rock, Inc.	sg	P.O. Box 65, Oildale	Oildale
Kern Rock Co.	sg	P.O. Box 1697, Bakersfield	Bakersfield
Mojave Rock Products	rg	9452 E. Garvey, El Monte	Mojave

Phoenix Construction Co.	sg	1601 S. Union Ave., Bakersfield	Bakersfield
Triangle Rock Products, Inc.	sg	Inyokern	Inyokern
Webster Sand Co.	s	P.O. Box 271, Bakersfield	Bakersfield
Lake County:			
Cache Creek Gravel Co.	sg	Box 597, Clearlake Highlands	Clearlake Highlands
Frazell, F. M.	sg	P.O. Box 914, Lakeport	Kelseyville
Gheislen, Marion R.	sg	Clearlake Oaks	Clearlake Oaks
Hellgren, Rodger E.	sg	P.O. Box 420, Clearlake Highlands	Clearlake Highlands
Lang Bros.	sg	P.O. Box 66, Lakeport	Lakeport
Lassen County:			
Lester L. Rice & Sons	sg, cr	P.O. Box 408, Yuba City	Adin
Los Angeles County:			
A. & H. Granite Co.	dg	1534 Broadway, Burbank	Burbank
Arrow Rock Co.	sg	11670 Wicks St., Sun Valley	Sun Valley, Monrovia
Arrow Sand & Gravel Co.	sg, cr	P.O. Box 75, Palmdale	Palmdale
Azusa Rock & Sand Co.	sg	P.O. Box 575, Azusa	Azusa
Bill & Rudy's Sand & Gravel	sg	P.O. Box 1096, Walteria	Walteria
Blue Diamond Corp., Ltd.	sg	1650 S. Alameda St., Los Angeles 54	El Monte, Sun Valley, Little Rock
C. & R. Sand Co.	s	3467 Greenfield Ave., Los Angeles 34	El Segundo
California Materials Co.	cr	P.O. Box 110, Whittier	Whittier
Caswell & Co.	ms	2357 E. Slauson Ave., Los Angeles 58	Torrance
Chandler's Palos Verdes Sand & Gravel	sg	P.O. Box 295, Lomita	Lomita
Connolly-Pacific Co.	rr, cr	1925 Water St., Long Beach 2	Catalina Island
Consolidated Rock Products Co.	sg, cr	Box 2950, Terminal Annex, or 2730 E. Alameda St., Los Angeles 54	Los Angeles, Azusa, Roscoe, Monrovia, Sun Valley, Irondale, North Hollywood
Ferry, John M.	sg	5201 San Fernando Rd., Glendale 3	Littlerock
Gordon Sand Co.	ms, bs	P.O. Box 128, El Segundo	Inglewood
Graham Bros., Inc.	sg, cr	5500 N. Peck Rd., El Monte	El Monte
Granite Materials	sg	12455 Wicks St., North Hollywood	Sun Valley
Lindauer Corp.	sg	Box 337, La Habra	La Habra
Livingston Rock & Gravel Co.	sg, rr, cr	3366 Cherry Ave., Long Beach 7	Azusa, Sunland, Newberry Park
Los Angeles Decomposed Granite Co.	dg	P.O. Box 39, Montebello	Montebello, Newberry Park
McCaslin Materials Co.	rr, cr	701 Foothill Blvd., Arcadia	Arcadia
McIlroy Blastsand Co.	bs	115 Nevada St., El Segundo	El Segundo
Manning Bros. Rock & Sand Co.	sg	P.O. Box C, Irwindale	Irwindale
Miller Bros. Truck Co.	ms	3451 Randolph St., Huntington Park	Redondo Beach, Torrance
Owl Rock Products Co.	dg, cp	P.O. Box 509, Compton	Monrovia
Pacific Rock & Gravel Co.	sg, dg	Box 778, Arcadia	Monrovia
Paramount Sand Co.	bs	1617 El Segundo, El Segundo	El Segundo

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Los Angeles County:—Continued			
Saugus Sand & Gravel Co.	sg	17125 E. Kings Canyon Rd., Saugus	Saugus
Edward Sidebotham & Sons	sg	751 E. L St., Wilmington	Lomita
Sierra Rock Products	sg	P.O. Box 125, Artesia	Monrovia
C. O. Sparks & Mundo Engineering Co.	sg	1711 S. Soto St., Los Angeles 23	Monrovia
Terminal Rock & Sand	sg	6851 East Ave., Littlerock	Littlerock
Torrance Sand & Gravel Products	sg	25701 Crenshaw Blvd., Torrance	Torrance
West Coast Aggregates Corp.	sg	P.O. Box 341, Pomona	Claremont
Madera County:			
Herndon Rock Products	sg	P.O. Box 886, Fresno 14	Herndon
Pinedale Rock & Sand Co.	sg	2233 W. Princeton Ave., P.O. Box 4074, Fresno	Pinedale
San Joaquin Valley Pipe Co.	sg	P.O. Box 215, Chowchilla	Chowchilla
Thompson Materials & Construction Co., Inc.	sg	917 Dome St., Avenal	Madera
Valley Feed & Fuel Co.	sg	121 N. F St., Madera	Madera
Marin County:			
Basalt Rock Co.	cr, rr	Eighth and River Sts., Napa	McNear Point
Black Point Aggregates, Inc.	sg	c/o Niles Sand & Gravel, P.O. Box 155, Niles	Black Point
Joslin Bros.	sg	Point Reyes	--
Hutchinson Co.	cr, m, r, rr	7360 Schmidt Lane, El Cerrito	Greenbrae
Marin Rock & Asphalt Inc.	cr	206 Patterson Bldg., Omaha 2, Nebraska	Novato
Mariposa County:			
Henley, Kenneth	sg	Groveland	Groveland
Mariposa Sand & Gravel Co.	sg	Box N., Mariposa	Mariposa
Saye, Wm. J. Sr.	sg	P.O. Box 60, Mariposa	Mariposa
Mendocino County:			
Guy F. Atkinson Co.	sg	10 W. Orange St., S. San Francisco	Ukiah
Baxman, E. F.	sg	Rt. 1, Box 433, Fort Bragg	Fort Bragg
Ellison Gravel Co.	sg	122 Harold St., Fort Bragg	Point Arena
Ford Gravel Co.	sg	P.O. Box 217, Ukiah	Ukiah
Frost & Fitzhugh	sg	Willits	Willits
Hastings, Harold P.	sg	P.O. Box 546, Lakeport	Bluff
Hull, Tom	sg	930 Carson St., Eureka	Rockport
Persico, Peter	sg	P.O. Box 516, Willits	Willits
Ukiah Gravel & Cement Co.	sg	P.O. Box 187, Ukiah	Ukiah
Woodruff, Warren S.	sg	Laytonville	Laytonville

Merced County:			
LeGrand Sand & Gravel Co., c/o Hammer Bros.	sg	P.O. Box 232, LeGrand	LeGrand
Los Banos Gravel Co.	sg	P.O. Box 1111, Los Banos	Los Banos
River Rock, Inc.	sg	20 E. 15th St., Merced	Atwater, Snelling
Turlock Rock Co.	sg	P.O. Box 548, Turlock	Balico
Modoc County:			
Moyer Gravel Co.	sg	P.O. Box 25, Alturas	Alturas
Monterey County:			
Cazin, Max	sg	Box 9, Metz Rd., King City	King City
Del Monte Properties Co.	sg, ms, dg	P.O. Box 150, Pacific Grove	Pacific Grove
Ferini, Guido O.	sg	Box 402, Santa Maria	Loneoak
Henningson, E. A.	dg	440 Rico, Salinas	--
Monterey Sand Co.	sg, fs	Box 928, Monterey	Seaside
Owens-Illinois Glass Co.	gs	P.O. Box 1035, Toledo, Ohio	Pacific Grove
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Lapis, Prattco
Pfyffer, Fred	sg, ms	King City	King City
Seaside Sand & Gravel Co., Inc.	sg	P.O. Box 513, Marina	Marina
Valley Paving & Construction Co., Inc.	sg	P.O. Box 6, Pismo Beach	--
Napa County:			
Basalt Rock Co.	cr, m, rr	Eighth and River Sts., Napa	Napa
Benson Gravel Plant	sg	P.O. Box 341, Angwin	Pope Valley
Dressler, R. E.	sg	1131 Frances, Napa	Napa
D. Ellsworth & Son	sg	1090 Summit, Napa	Napa
Snodgrass, Jane	cr	Rt. 1, Box 32A1, Calistoga	Calistoga
Nevada County:			
Hansen, A. O. and K. M.	sg	Rt. 1, Box 472-L, Grass Valley	Grass Valley
Winkle, Robert P.	sg	Rt. 2, Box 2256, Grass Valley	Grass Valley
Orange County:			
Ansco Construction	s	2725 Atlantic, Long Beach	Olive
Burris sand pit, Bessie M. Calhoun	s	Box 1741, Santa Ana	Anaheim
California Non-Metallics	s	Robinson Ranch, Trabuco Mesa, San Juan Capistrano	El Toro
Certified Sands	s	Anaheim	Anaheim
Consolidated Rock Products Co.	sg, b, r, rr, etc.	2730 S. Alameda St., Los Angeles 54	Fullerton, Orange
Foster Sand & Gravel Co.	sg	915 S. Spadra Rd., Fullerton	Orange
Frye, V. J.	ms	1901 N. Olive St., Santa Ana	Newport Beach
Graham Bros., Inc.	sg, b, r, rr, etc.	5500 N. Peck Rd., El Monte	San Juan Capistrano
Graves Sand & Gravel, Inc.	sg	2203 S. Redwood Dr., Anaheim	Atwood
D. D. Lawhead & Son	sg	111 14th St., Seal Beach	Buena Park
Longsdon Sand Plant	s	12261 E. Chapman Ave., Anaheim	Anaheim
Lumley, Earl	s	1219 Studebaker, Long Beach	Olive
McClellan & Sons	s	151 Commercial Way, Costa Mesa	Anaheim

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Orange County:—Continued			
Miller & Hansen Sand & Gravel	sg	14292 Narles Dr., Santa Ana	Anaheim
Miller Bros. Trucking Co.	ms	3451 Randolph St., Huntington Park	Santa Ana
R. J. Noble Co.	sg	P.O. Box 620, Orange	Orange
Orange County Rock Producers	sg	P.O. Box 125, Artesia	Artesia
Pharris, C. L.	s	16252 E. Taft, Orange	Olive
James Sparkes sand pit	s	P.O. Box 589, Anaheim	Anaheim
Sully-Miller Construction Co.	sg	P.O. Box 432, Orange	El Modena
Placer County:			
Chevreaux, Joe	sg	P.O. Box 65, Station A, Auburn	Auburn
Deer Park Ready Mix	sg	Tahoe City	Tahoe City
Fredrickson & Watson Construction Co.	sg	873 81st Sts., Oakland 3	Dutch Flat
Marshall & Miles Gravel Co.	sg	P.O. Box 458, Colfax	Colfax
Union Granite Co.	cr	P.O. Box 819, Rockland	Rockland
Plumas County:			
Gillespie, F. E.	sg	2377 Sunrise Dr., Reno, Nevada	Blairsden
McClain, E. G.	sg	Crescent Mills	Crescent Mills
Parkwald-Havins & M. K.	cr	P.O. Box 4175, Sacramento	--
Western Pacific R. R.	cr	526 Mission St., San Francisco	--
Riverside County:			
Clifford C. Bong & Co.	sg	123 N. Third Ave., Arcadia	Elsinore
Co-Val Concrete Pipe Co.	sg	Gravel Plant, Ave. 56, Thermal	Coachella
Gunther-Shirley-Lane Co.	cr	4560 Sherman Oaks Ave., Sherman Oaks	--
Haven Granite Corp.	pg	890 S. Arroyo Parkway, Pasadena 2	Riverside
W. E. Kier Construction Co.	sg, rr	2323 E. Rosecrans, El Segundo	Bertha
Massey Rock & Sand Co.	sg	Box 695, Indio	Indio
Minnesota Mining & Mfg. Co.	rg, cr	900 Fauquier Ave., St. Paul 6, Minn.	Corona
Owens-Illinois Glass Co.	gs	P.O. Box 1035, Toledo 1, Ohio	Corona
Palm Springs Builders Supply Co.	sg	490 Sunny Dunes Rd., Palm Springs	Whitewater
Ripley Material	sg	6740 Pedley Rd., Arlington	Arlington
San Gorgonio Rock Products	sg	1990 N. Hargrove St., Banning	Banning
Shipwells	sg	P.O. Box 87, Blythe	Blythe
Stringfellow, J. B.	cr	P.O. Box 6, Riverside	Riverside
Transit Mixed Concrete Co.	sg	3464 E. Foothill Blvd., Pasadena	Corona
Valley Rock & Sand Corp.	sg	P.O. Box 926, San Jacinto	Moreno

Sacramento County:			
Asta Construction Co.	sg	P.O. Box 758, Rio Vista	Rio Vista
Brighton Sand & Gravel Co.	sg	P.O. Box 1, Perkins	Perkins
Del Paso Rock Products Co.	sg	3490 Fair Oaks Blvd., Sacramento	Del Paso
Fair Oaks Gravel Co.	sg	4000 Illinois Ave., Fair Oaks 19	Fair Oaks
Haggin Gravel Co.	sg	P.O. Box 1072, Sacramento	Sacramento
Hard Materials Co.	ms	12th and Vine Sts., Sacramento	Sacramento
Harms Bros.	sg	5261 Stockton Blvd., Sacramento	--
McGillivray Construction Co.	sg	P.O. Box 873, Sacramento	Sacramento
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Fair Oaks, American River
Robert Powell Products, Inc.	s	P.O. Box 1412, Sacramento	Sacramento
Robertson Sand & Gravel Co.	sg	1061 Vine St., Sacramento	Sacramento
A. Teichert & Son, Inc.	sg	P.O. Box 928, Sacramento 4	Perkins
San Benito County:			
Granite Rock Co.	cr, m, b, rr	Box 151, Watsonville	Logan
San Bernardino County:			
Barstow Rock & Gravel Co.	sg	P.O. Box 808, Barstow	Barstow
Base Rock Co., Inc.	sg	P.O. Box 107, Claremont	North Claremont
Brubaker-Mann Co.	rg	R.F.D. 1, 30984 Soap Mine Rd., Barstow	Barstow
Burton, Cecil	sg	P.O. Box 15, Fawnskin	Bear Lake
Central Rock Co.	sg	1465 E. 16th St., Upland	Upland
Consolidated Rock Products Co.	sg	2730 S. Alameda St., Los Angeles	Monte Niete
Dana Materials Co.	sg	P.O. Box 187, Apple Valley	Daggett
Daniel & Dixon Co., Inc.	sg	P.O. Box 134, Cross Roads	Earp
Frank Day & Co.	sg	P.O. Box 264, Big Bear Lake	Big Bear Lake
Fourth St., Rock Crusher	sg	P.O. Box 469, San Bernardino	San Bernardino
Gabriel Rock	sg	W. Base Line at Little Creek, San Bernardino	San Bernardino
Hammermilled Crushed Rock Co.	rg	13555 Live Oak, Duarte	--
Hanawalts	sg	4594 San Bernardino Ave., Ontario	Pomona
Hi-Desert Concrete Products, Inc.	sg	--	Yucca Valley
Hubbs Bros. Trucking	cr	129 Deberry Grand Terrace, Colton	Colton
Mojave Rock Materials Co.	sg	P.O. Box 434, Barstow	Barstow
Mountain Rock Products	sg, cr	20th and Benson, Upland	Upland
Rainbow Rock, Inc.	rg	P.O. Box 306, Barstow	Barstow
San Bernardino Rock and Gravel Co.	sg	1910 W. Seventh St., San Bernardino	San Bernardino
Service Rock	sg	P.O. Box 309, Riverside	Colton, Rialto
W. J. Smithson & Co.	dg	Box 28, Big Bear Lake	Bear Lake
Triangle Rock Products, Inc.	sg	2400 W. Highland Ave., San Bernardino	San Bernardino, Fontana, Oro Grande
Tri-City Transit Mix Cement Co.	sg	1910 W. Seventh St., San Bernardino	--
Union Pacific Railroad Co.	sg, b	1416 Dodge St., Omaha 2, Neb.	Baxter

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
San Diego County:			
American Sand Co.	bs	P.O. Box 5326, San Diego 5	San Diego
Beeler Canyon Sand & Gravel Co.	sg	Hollydale	Hollydale
Carlson Rock & Sand Co.	sg	2763 State St., Carlsbad	Carlsbad
Caudell & Johnson	sg	P.O. Box 3098, Hillcrest Sta., San Diego	Mission Valley
Condrey, E. E.	dg		--
Daley Construction Co.	sg	Mission Rd., San Diego	San Diego
W. R. Dennis Construction Co.	sg, cr	P.O. Box 3158, Hillcrest Sta., San Diego	San Diego
Denton's Sand Plant, Edmond Denton	sg	4111 Poplar St., San Diego 5	El Cajon
Einer Bros., Inc.	dg	P.O. Box 936, Escondido	Escondido
Escondido Quarries, Inc.	cr	530 W. Sixth St., Los Angeles	Escondido
H. G. Fenton Materials Co., Inc.	sg	1245 National Ave., San Diego 12	San Diego
Kenneth Golden Construction Co., Inc.	cr	Rt. 1, Box 891, San Diego	San Diego
Gross Sand Co.	s	Gen. Del., Lakeside	Lakeside
C. R. Guthridge Sand Plant	s	Rt. 1, Box 52, Del Mar	Del Mar
Jamacha Sand Plant	s	Rt. 1, Box 653, El Cajon	El Cajon
Knox, John	cr	Highway 94, Campo	Campo
Monarch Materials Co.	sg	P.O. Box 64, San Diego 12	San Diego
Nelson & Sloan	sg, cr	Seventh and Main Sts., Otay	Chula Vista
Ottawa Silica Co.	ms, fs, s	Ottawa, Illinois	Oceanside
Patterson Trucking	rr, cr, dg	Lakeside	Lakeside
H. W. Rohl Co., Inc.	sg	P.O. Box 28, Oceanside	Oceanside
Sierra Sand Co.	s	Rt. 2, Box 1095, Lakeside	Lakeside
Smith Construction Co.	sg	P.O. Box 247, Cardiff-by-the-Sea	Rancho Santa Fe
Weaver, Don M.	cr	Jacumba	Jacumba
Woodward Sand Co., Arthur C. Woodward	sg	2914 Bancroft St., San Diego 4	San Diego
Zinniger, Lou	sg	150 Via de la Ville, Rancho Santa Fe	Rancho Santa Fe
San Francisco County:			
Charles L. Harney, Inc.	cr, fr	575 Berry St., San Francisco 7	San Francisco
San Joaquin County:			
R. A. Farish Co.	sg	P.O. Box 307, Stockton 1	Linden
S. M. McGaw Co.	sg	307 Elks Bldg., Stockton, Box 767	Bellala
Munn & Perkins	sg	P.O. Box 1092, Modesto	Escalon
Nomellini & Funk	sg	P.O. Box 1528, Stockton	Vernalis
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Tracy
Putman Sand & Gravel Co., Inc.	sg	200 Santa Rosa Ave., Modesto	Riverbank
A. Teichert & Son, Inc.	sg	P.O. Box 928, Sacramento	Tracy
H. C. Thompson Sand Dredging Co.	sg	P.O. Box 403, Alameda	--
Claude C. Wood Co.	sg	P.O. Box 599, Lodi	Clements

San Luis Obispo County:			
Grant, John	sg	Rt. 1, Box 652, Arroyo Grande	Oceano
Guiton Foundry Supply	ms	P.O. Box 258, Oceano	Oceano
Madonna Construction Co.	sg	P.O. Box 910, San Luis Obispo	Cambria
Mitchell & Moss	sg	Cambria	Cambria
Mitty Construction Co.	cr	P.O. Box 59, Santa Maria	Santa Maria
O'Kelly, J. A.	cr	3159 S. Broadway, San Luis Obispo	--
Morro Rock & Sand Co.	sg	P.O. Box 694, Morro Bay	Cambria
Walter B. Roselip Co.	sg	Box 458, Atascadero	Atascadero
Valley Paving & Construction Co., Inc.	sg	P.O. Box 6, Pismo Beach	San Luis Obispo, Paso Robles
San Mateo County:			
Archibald, J. O.	dg	P.O. Box 968, Redwood City	--
Furrer, John	cr	5201 San Fernando Rd., Glendale	--
Marks Materials, Inc.	cr	P.O. Box 806, Belmont	Rockaway Beach
McCammon-Wunderlich	cr, dg	P.O. Box 359, Palo Alto	--
Pacific Cement & Aggregates, Inc.	cr, s	400 Alabama St., San Francisco 10	Brisbane and Junipero Serra Blvd.
Rockaway Quarry, Inc.	s	400 Montgomery St., San Francisco	Rockaway Beach
Skyline Materials, Inc.	cr	P.O. Box 806, Belmont	Belmont
Smith, L. C.	dg, cr	225 19th Ave., San Mateo	--
Santa Barbara County:			
Arnoldi, G.	cr	600 Olive, Santa Barbara	Santa Barbara
Guy F. Atkinson Co.	cr	P.O. Box 259, Long Beach	--
Buellflat Rock Co.	sg	Solvang	Solvang
Fredrickson & Watson Construction Co.	sg	873 81st St., Oakland	Santa Barbara
Southern Pacific Milling Co.	sg	P.O. Box 491, Ventura	Santa Maria
Valley Rock & Sand Co.	sg	218 S. "L" St., Lompoc	Santa Ynez
Santa Clara County:			
Bahr & Ledoyen, Inc.	cr	3291 Park Blvd., Palo Alto	Los Altos
J. C. Bateman, Inc.	sg	650 Stockton Ave., San Jose	San Jose
Besler, J. P.	sg	17497 Almaden Rd., San Jose	--
Billings, J. L.	fr	P.O. Box 307, Milpitas	Milpitas
Calaveras Crushed Rock Co.	fr	Old Calaveras and Evans Rd., Milpitas	Milpitas
Bren's Gravel & Sand	sg, fr	211 Princeville St., Gilroy	Gilroy
Canha, Louis	sg	Catherine and Gold, Alviso	San Jose
Houson's, Inc.	s	738 N. Monterey St., Gilroy	Gilroy
Los Gatos Sand & Gravel Co.	sg	P.O. Box 502, Los Gatos	Los Gatos
Mirassou Bros.	cr	15630 Harwood Rd., Los Gatos	Los Gatos
Neary Rock Quarry, Inc.	cr	11920 Stonebrook Rd., Los Altos	Los Gatos
Pacific Cement & Aggregate, Inc.	sg	400 Alabama St., San Francisco 10	Coyote
Permanente Cement Co.	cr	Permanente	Permanente
Leo F. Piazza Paving Co.	sg	985 Downer Ave., San Jose	San Jose
A. J. Raisch Paving Co.	sg	900 W. San Carlos St., San Jose	San Jose

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Santa Clara County:—Continued			
Reed & Graham, Inc.	sg	690 Sunol, San Jose	San Jose
Roggasch Bros. Quarry	cr	P.O. Box 422, Los Gatos	Los Gatos
Saratoga Gravel, Inc.	sg	14731 Pierce Rd., Saratoga	Saratoga
Sondgrath Bros. Rock Co.	cr, sg	P.O. Box 1055, Mountain View	Los Altos
Terra Commercial Co.	sg	375 Umbarger Rd., San Jose	San Jose
Tonelli, David	sg	Bayshore and Oakland Hwy., San Jose	San Jose
Voss, A.	sg	10445 Stevens Creek Rd., Cupertino	Stevens Creek
Western Gravel Corp.	sg	P.O. Box 1026, Campbell	Campbell
Western Tile & Supply Co.	sg	P.O. Box 104, Gilroy	Gilroy
Xavier Sand & Gravel	sg	Diana Ave., Morgan Hill	Morgan Hill
Santa Cruz County:			
Concrete Service Co.	sg	860 Sunol St., San Jose	Scotts Valley
Graham & Son	sg	500 Mt. Herman Rd., Santa Cruz	Santa Cruz
Hansen, Silvey & Sinnot	cr	P.O. Box 375, Felton	Felton
Henry J. Kaiser Co.	s	1924 Broadway, Oakland 12	Olympia, Felton
V. W. Maddock	cr	P.O. Box 177, Soquel	Soquel
Pacific Cement & Aggregate, Inc.	s	400 Alabama St., San Francisco 10	Felton
Pacific Limestone Products Co.	cr	445 Spring St., Santa Cruz	Santa Cruz
Santa Cruz Aggregate Co.	sg	646 Lockhart Gulch Rd., Santa Cruz	Felton, Olympia
United Builders & Farmers Supply	sg	P.O. Box 96, Soquel	Soquel
Shasta County:			
T. B. Dodson Pit	sg	Balls Ferry Rd., Anderson	Anderson
J. H. Hein Co.	sg	P.O. Box 226, Redding	Redding
Kerns, Leland	sg	Burney	Burney
Lassen Sand & Gravel	sg	Cassel	Cassel
Oaks Sand, Gravel & Cement Products Co.	sg	P.O. Box 1847, Redding	Redding
Peeler, Bert C.	sg	P.O. Box 131, McArthur	McArthur
Redding Sand & Gravel Co., Inc.	sg	P.O. Box 741, Redding	Redding
Riley Trucking Co.	sg	P.O. Box 1462, Redding	Redding
Valentine, A. G.	sg	Burney	Burney
Siskiyou County:			
Clements Construction Co.	sg	P.O. Box 667, Fremont	Tulelake
Mt. Shasta Gravel Co.	sg	P.O. Box 836, Mt. Shasta	Mt. Shasta
Silva, M.M	sg	1263 S. Main, Yreka	Yreka

Williamson, George	sg	South Highway, Mt. Shasta	Mt. Shasta
Young, Albert	sg	112 Fourth St., Yreka	Yreka
Solano County:			
Asta Construction Co.	sg	P.O. Box 758, Rio Vista	Rio Vista
Fredrickson Bros.	cr, fr, sg	1257 65th St., Emeryville	Suisun
Nelson, J. M., Cordelia quarry	cr, rr	Rt. 1, Suisun	Cordelia
Parish Bros., Inc.	cr, rr	1205 E. Second St., Benicia	Benicia
Parish Bros., Inc., & Harris Bros.	sg	Travis Air Force Base	Denverton
Solano Excavator	cr	130 E. O St., Benicia	--
Sonoma County:			
Basalt Rock Co.	sg	P.O. Box 5401, Eighth and River Sts., Napa	Healdsburg
Cloverdale Ready Mix	sg	P.O. Box 451, Cloverdale	Cloverdale
Construction Supply Co.	sg	1330 King St., Santa Rosa	Mirabel
Empire Rock Co., Inc.	sg	3851 E. Montgomery Dr., Santa Rosa	Santa Rosa
Graham, Thomas A.	cr, m	Box 1, Occidental	Occidental
Hein Bros. Basalt Rock Co., Mark Hein, pres.	sg, cr, m, b	P.O. Box 162, Petaluma	Petaluma, Windsor
Parish Bros., Inc.	cr	1205 Second St., Benicia	Goodyear
Talbert Rock Quarry	cs	P.O. Box 92, Cotati	Cotati
Windsor Sand & Gravel	sg	Windsor	Windsor
Stanislaus County:			
American Sand & Gravel Co.	sg	Ninth and M Sts., Modesto	Empire
Graystone Black Sand Pit	s	316 River Rd., Modesto	Modesto
Hughson Gravel Plant	sg	P.O. Box 35, Hughson	Hughson
Marks, Frank B., Jr.	sg	P.O. Box 668, Newman	Newman
Modesto Sand & Gravel Co., Inc.	sg	P.O. Box 496, Salida	Salida
Reed, George	sg	529 Covena Ave., Modesto	Waterford
M. J. Ruddy & Sons, Santa Fe Rock & Sand Branch	sg	Rt. 6, Box 1419A, Modesto	Waterford, Oakdale
Standard Rock Co.	sg	P.O. Box 696, Escalon	Escalon
Sykes, H.	sg	P.O. Box 998, Patterson	Patterson
Chas. D. Warner & Sons, Inc.	sg	1027 Yosemite Blvd., Modesto	Hickman
Sutter County:			
Perry & Rowe	sg	P.O. Box 297, Live Oak	Live Oak
Lester Rice & Son	sg	P.O. Box 408, Yuba City	Yuba City
Stineman Sand & Gravel	sg	Rt. 1, Box 10, Wheatland	Wheatland
Tehama County:			
Allen & Reddy Sand & Gravel	sg	Box 729, Red Bluff	Red Bluff
Ehorn, Richard	sg	124 S. Jackson, Red Bluff	Red Bluff
Globe Building Supply, Inc.	sg	P.O. Box 637, Concord	Richfield
Red Bluff Sand & Gravel Co.	sg	P.O. Box 1847, Redding	Red Bluff
Lester L. Rice & Sons, Inc.	cr	P.O. Box 408, Yuba City	--

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Trinity County:			
Arbuckle & Garrison Ready Mix	sg	Box 148, Lewiston	Lewiston
Northwestern Pacific RR Co.	cr	San Rafael	Island Mountain
Transocean Construction Co.	sg	7807 Russel City Rd., Hayward	Minersville
Trinity Sand & Gravel Co.	sg	Weaverville	Douglas City
Tulare County:			
Middletons-Sequoia Rock Co.	sg	P.O. Box 1468, Visalia	Porterville
Pacific Cement & Aggregate, Inc.	sg	400 Alabama St., San Francisco 10	Lemon Cove
E. T. Quiram & Sons	sg	406 Garden St., Porterville	Porterville
Tuolumne County:			
Beerman & Jones	sg, rr	P.O. Box 698, Sonora	Soulsbyville
A. P. Jones, Sierra Sand & Gravel	sg	Jamestown, P.O. Box 504	Sonora
Woof, Paul E.	sg	2203 N. Fruit Ave., Fresno	Tuolumne
Ventura County:			
Guy F. Atkinson Co.	cr	P.O. Box 259, Long Beach 1	--
Central Valley Building Supply	sg	7030 Canby Ave., Reseda	Moorpark
Oswald J. Da Ros	cr	975 Carrillo Rd., Santa Barbara	Casitas
Miller Bros. Truck Co.	ms	3451 Randolph St., Huntington Park	Ventura
Saticoy Rock Co.	sg	Box 970, Ventura	Saticoy-Ventura
Southern Pacific Milling Co., Santa Paula Rock Div.	sg	P.O. Box 491, Ventura	El Rio, Montalvo, Santa Paula
Yolo County:			
Pacific Cement & Aggregate, Inc.	sg	400 Alabama St., San Francisco 10	Yolo
Schwarzgruber & Sons	sg	28 W. Main St., Woodland	Cache Creek
A. Teichert & Sons	sg	P.O. Box 928, Sacramento 4	Woodland
Wood, Mrs. Lucy S.	sg	915 First St., Woodland	Woodland
Yuba County:			
Lester Rice & Son	sg	P.O. Box 408, Yuba City	Marysville
Yuba River Sand Co.	sg	Box 307, Marysville	Marysville

† Under the heading Miscellaneous Stone are four divisions—crushed rock, grinding mill pebbles, paving blocks, and sand and gravel. Crushed rock includes crushed rock that is used in macadam, ballast, and for concrete; also rock used for rubble and riprap.
The California State Highway Commission, the various counties, cities, the U. S. Engineers, the U. S. Bureau of Reclamation, the U. S. Forest Service, the U. S. National Park Service, and the U. S. Bureau of Public Roads produce both crushed rock and sand and gravel in various places in the state, to be used in the construction and maintenance of highways, but is not specified in this listing.

* b, Ballast; bs, Blast sand; cr, Crushed rock; dg, Decomposed granite; fr, Fill rock; fs, Filter sand; g, Ganister; gs, Glass sand; m, Macadam; ms, Molding sand; pg, Poultry grit; r, Rubble; rg, Roofing granules; rr, Riprap; s, Sand; sg, Sand and gravel.

Silver †

Mine	Type of mine*	Operator	Address	Postoffice of mine
El Dorado County:				
Hazel Creek	g	Hazel Creek Mining Corp.	P.O. Box 3508, North Sacramento	Sly Park
Humboldt County:				
Copper Bluff	c	Providence Tuolumne Gold Mines, Inc.	1686 Union St., San Francisco	Hoopa
Inyo County:				
Darwin group	l	The Anaconda Co.	P.O. Box 58, Darwin	Darwin
Defense	l	Foreman & Foreman	P.O. Box 175, Darwin	Panamint Springs
Minnietta	l	August Choop and Robert H. Allsop	1640 W. 147th St., Gardena	Panamint Springs
Pine Creek	t	Union Carbide Nuclear Co., Division of Union Carbide Corp.	Rm. 2115-30, E. 42d St., New York 17, N. Y.	Bishop
Santa Rosa	l	Thomas D. Norris	P.O. Box 111, Keeler	Keeler
Shoshone group	l	The Anaconda Co.	P.O. Box 58, Darwin	Shoshone
Silver Reid	l	Lone Pine Mining & Development Co.	P.O. Box 296, Lone Pine	Lone Pine
Mono County:				
Topaz	l	Metallurgical Development	P.O. Box 101, Gardnerville, Nev.	----
Sacramento County:				
Natomas	d	Natomas Co.	P.O. Box 1197, Sacramento	Folsom
San Bernardino County:				
Kelly	s	Frank W. Royer	Red Mountain	Red Mountain
Silver Prince	l	E. J. McClellan et al.	P.O. Box 784, Big Bear Lake	Big Bear Lake
Sierra County:				
Original 16 to 1	g	Original 16 to 1 Mine	Rm. 1611, 235 Montgomery St., San Francisco 4	Alleghany
Siskiyou County:				
Siskon	c	Siskon Corp.	P.O. Box 148, Happy Camp	Happy Camp
Yuba County:				
Yuba	d	Yuba Consolidated Gold Fields, Div. of Yuba Consolidated Industries	357 California St., San Francisco	Hammonton

† Principal silver producers only; does not include producers of less than 1,000 oz.
* c, Copper mine; d, Gold bucket-line dredge; g, Gold mine; l, Lead mine; s, Silver mine; t, Tungsten mine.

Slate

Operator	Address	Location
El Dorado County:		
Pacific Minerals Co., Ltd., (granules, filler)	337 10th St., Richmond	Chili Bar
Placerville Slate Products Co.	Placerville	Chili Bar
Mariposa County:		
Agua Fria Slate quarry	Mariposa	

Soda

Operator	Address	Location
Inyo County:		
Pittsburgh Plate Glass Co., Columbia Chemical Division (soda ash, trona)	Bartlett	Bartlett
Kern County:		
Pacific Coast Borax Co. (salt cake)	P.O. Box 9128, Sta. S, Los Angeles	Boron
San Bernardino County:		
American Potash & Chemical Corp. (soda ash, salt cake)	3030 W. Sixth St., Los Angeles 54	Trona
West End Chemical Division, Stauffer Chemical Co. (soda ash and salt cake)	1956 Webster St., Oakland 12	Westend

Dimension Stone (other than Granite)

Operator	Product*	Address	Location
El Dorado County:			
T. C. Nutt	f	P.O. Box 9, Placerville	Placerville
Sierra Placerite Corp.	f	Rt. 3, Box 252, Placerville	Placerville
Inyo County:			
Harry W. Amey	b	Box 77, Death Valley Junction	Death Valley Junction
Stutterite Stone Co.	a	Box 84, Castaic	Trona
Kern County:			
N. W. Sweetser	c	P.O. Box 445, Rosamond	Rosamond

Los Angeles County:			
Robert Cox	a	1975 Lundy Ave., Pasadena	Pasadena
Great Lakes Carbon Corp.	d	612 S. Flower St., Los Angeles 17	Palos Verdes
H. A. Jones	j	215 W. Green St., Pasadena	Bouquet Canyon
Don Poteet	j	10947 Haddon Ave., Pacoima	Bouquet Canyon
Frank P. Raggio	j	Rt. 2, Box 353, Saugus	Saugus
Victor B. Williams	j	2605 Honolulu Ave., Montrose	Bouquet Canyon
Monterey County:			
Porter-Marquard Carmel Stone Quarry	c, k	Rancho Canada, Carmel Valley	Carmel Valley
Riverside County:			
Arlington Stone Co.	a	6086 Crowell, Arlington	Arlington
California Limestone Products Co.	h	139 S. Beverly Dr., Beverly Hills	Blythe
Lawrence Johnson	h	P.O. Box 821, Blythe	Blythe
U. S. Gypsum Co.	a	300 W. Adams St., Chicago 6, Ill.	Midland
San Bernardino County:			
Champion Materials Co.	a	1851 Victory Blvd., Glendale	----
W. C. Higdon, Marbolite quarry	a, c	Box 12, Knotts Berry Farm, Buena Park	----
San Diego County:			
Arut Carlsen	c	595 Mountain View Rd., La Cresta	La Cresta
San Luis Obispo County:			
Great Lakes Carbon Corp.	d	612 S. Flower St., Los Angeles 17	Paso Robles
Santa Barbara County:			
G. Antolini & Sons	e	131 E. Gutierrez St., Santa Barbara	Santa Maria
Santa Clara County:			
Mirassou Bros.	g	15630 Harwood Rd., Los Gatos	Lone Hill
Santa Cruz County:			
Pacific Limestone Products Co.	b	445 Spring St., Santa Cruz	Santa Cruz
Sonoma County:			
Paul Cabrol	f	190 Seaview, San Rafael	Glen Ellen
Cliff Reed	f	901 Triniti Rd., Glen Ellen	Glen Ellen
Saint Helena Stone Co.	f	P.O. Box 413, San Anselmo	Glen Ellen
J. B. Wingate & Son	f	585 Triniti Rd., Glen Ellen	Glen Ellen
Tuolumne County:			
Sonora Marble Aggregates	b	Rt. 1, Box 599, Sonora	Shaws Flat
Ventura County:			
Victor B. Williams	a	2605 Honolulu Ave., Montrose	Grimes Canyon

* a, Miscellaneous stone; b, Limestone: c, Sandstone: d. Diatomaceous shale; e, Calcareous siltstone; f, Volcanic tuff; g, Rhyolite; h, Wollastonite; j, Mica schist; k, Indurated shale.

Strontium Minerals

Operator	Address	Location
San Diego County:		
Pan Chemical Co.	3461 E. 26th St., Los Angeles	Fish Creek
San Bernardino County:		
Gene de Zan	605 G St., Bakersfield	Cady Mountains

Sulfur

Operator	Address	Location
Alpine County:		
Anaconda Co.	25 Broadway, New York 4, N. Y.	Markleeville
Inyo County:		
Inyo Soil Sulfur Co. (R. E. Kitching)	310 Pacific St., Bakersfield	Big Pine
Lake County:		
Wolf Creek Mining Co.	Box 52, Clear Lake Highlands	Clear Lake Oaks

Mine	Type of mine*	Operator	Address	Location
El Dorado County:				
Huyden	b	Industrial Minerals & Chemical Co.	836 Gilman St., Berkeley	Shingle Springs
Swift	b	Pacific Mineral Products Co.	337 10th St., Richmond	Shingle Springs
Inyo County:				
Alliance and Silver Dollar	a	George W. Koest	P.O. Box 85, Darwin	Darwin
Big Talc	a	Louise Grantham & Associates	237 N. Second Ave., Upland	Shoshone
Blue Star, Colton, and Death Valley	a, c	Monte Little		Big Pine, Bishop, Shoshone
D & D	a	Harlis & Broady	Box 275, Big Pine	Big Pine
Eclipse	a	Kennedy Minerals Co., Inc.	2552 E. Olympic Blvd., Los Angeles	Tecopa
Eureka, Fresno, Rogers and Talc City	a	Sierra Talc & Clay Co.	1608 Huntington Dr., South Pasadena	Big Pine, Keeler
K & T	a	Charlie Chance	Big Pine	Independence
Mammoth	a	Tennessee Minerals, Inc.	821 N. Lima St., Burbank	Tecopa
White Eagle	a	Huntley Industrial Minerals, Inc.	P.O. Box 305, Bishop	Big Pine
White Mountain	a	William Bonham	P.O. Box 446, Lone Pine	Keeler
Los Angeles County:				
Katz	b	Dr. Leon N. Katz	9837 Foothill Blvd., San Fernando	Acton
Mono County:				
Pacific Pyrophyllite	c	Huntley Industrial Minerals, Inc.	P.O. Box 305, Bishop	Laws
San Bernardino County:				
Acme, Excelsior, Monarch, and Arletta	a	Southern California Minerals Co.	320 Mission Rd., Los Angeles 33	Tecopa, Shoshone
Caliente, Ibex, Rainbow, Sharp Creek, Silver Lake and Addenda, and Yucca Grove	a	Sierra Talc & Clay	1608 Huntington Dr., South Pasadena	Baker
Omega	a	Pomona Talc Co.	629 N. La Brea Ave., Los Angeles	Baker
Superior	a	Tri-State Minerals Co.	2005 Lincoln Ave., Ogden, Utah	Shoshone
Victor	c	Minerals Materials Co.	1145 Westminster Ave., Alhambra	Oro Grande
Western Talc	a	Western Talc Co.	1901 E. Slauson Ave., Los Angeles	Tecopa
San Diego County:				
Four Gee	c	Howard G. Golem	Rt. 1, Box 789, Escondido	Escondido
Harberlite	c	Harberlite Corp.	P.O. Box 458, Escondido	Escondido
Pioneer	c	Pioneer Pyrophyllite Products	Box 686, Chula Vista	Chula Vista
----	c	Charles Harris	Del Dios Highway, Rancho Santa Fe	Rancho Santa Fe

* a, Talc; b, Soapstone; c, Pyrophyllite.

Mine	Operator	Address	Location of mine
Calaveras County:			
Moore Creek	Moore Creek Mining Co.	P.O. Box 87, Pioneer	Pioneer
Inyo County:			
Brownstone	Brownstone Mining Co.	Box 376, Bishop	Bishop
Moonlight	T. H. Stokes	Rt. 1, Box 198, Bishop	Bishop
Pine Creek	Union Carbide Nuclear Co.	30 E. 42d St., New York 17, N. Y.	Bishop
Red Rock	Lawrence J. Ott	Big Pine	Trona
Red Hill Mill	C. O. Russell	Bishop	Bishop
Kern County:			
Billie Burke	Wm. H. Thorn	Box 580, China Lake	Randsburg
Lila King	Butte Lode Mining Co.	P.O. Box 195, Randsburg	Randsburg
Madera County:			
Victory Ridge	U. S. Tungsten Mines	736 Van Ness, Fresno	North Fork
Mariposa County:			
Garnet Queen	Gray Mining & Milling Co.	Box 86, El Portal	El Portal
Mono County:			
Black Rock	Wah Chang Corp.	137 Clarke St., Bishop	Benton
Nichols	Charles G. and Robert Scharf	524 N. Main St., Bishop	Crawley
Nevada County:			
Amanda	Caltung Mining Co.	1079 B St., Hayward	Grass Valley
San Bernardino County:			
Atolia	Surcease Mining Co.	214 30th St., Sacramento	Atolia
El Mirage	El Mirage Mining Co.	1603 N. Broadway, Santa Ana	Adelanto
El Mirage	Annal R. Lang	2101 Manitou, Los Angeles	Adelanto
San Diego County:			
Pay Off	P-K Mining & Milling Co.	P.O. Box 131, La Mesa	Cherry Creek
Tulare County:			
Big Jim	Tulare County Tungsten Mine	895 Lafayette Ave., Lindsay	Exeter
Royal	Apex Mining & Minerals Inc.	1003 E. Valley, San Gabriel	Three Rivers
Sherman Peak	Sherman Peaking Mining Co.	P.O. Box 583, Kernville	Kernville

Wollastonite *

Operator	Address	Location
Riverside County:		
California Limestone Products Co.	139 S. Beverly Dr., Beverly Hills	Midland
M. L. Jontz Co. (lessee)	Los Angeles	Midland
L. Johnson	P.O. Box 821, Blythe	Midland

* Wollastonite float used as ornamental stone.

Zinc *

Mine	Operator	Address	Postoffice of mine
El Dorado County:			
Hazel Creek	Hazel Creek Mining Co.	P.O. Box 3508, North Sacramento	Sly Park
Inyo County:			
Darwin group	The Anaconda Co.	P.O. Box 58, Darwin	Darwin
Santa Rosa	Thomas D. Norris	P.O. Box 111, Keeler	Big Pine
Shoshone group	The Anaconda Co.	P.O. Box 58, Darwin	Shoshone
Silver Reid	Lone Pine Mining & Development Co.	P.O. Box 296, Lone Pine	----
Silver Spoon	R. C. Finley	P.O. Box 657, Lone Pine	Darwin
White Mountain Lead	Richard Horne	Bishop	White Mountain
San Bernardino County:			
Silver Prince	E. J. McClellan et al.	P.O. Box 784, Big Bear Lake	Big Bear Lake

* Principal zinc producers only (producers of 10,000 pounds or more).

DIRECTORY OF SMELTERS AND MINERAL DEALERS REPORTING PURCHASE OF CALIFORNIA METALS

Name	Address	Location of plant	Metals reported purchased
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Amarillo, Tex.	Zinc
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	El Paso, Tex.	Copper, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Garfield, Utah	Copper, lead, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Hayden, Ariz.	Copper, gold, silver
American Smelting & Refining Co.	405 Montgomery St., San Francisco	Selby	Lead, copper, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Tacoma, Wash.	Copper, lead, gold, silver
Anaconda Co.	25 Broadway, New York 4, N. Y.	Anaconda, Mont.	Copper, lead zinc, gold, silver
Anaconda Co.	25 Broadway, New York 4, N. Y.	Great Falls, Mont.	Zinc
Bethlehem Pacific Coast Steel Corporation	20th and Illinois Sts., San Francisco	San Francisco	Iron ore
Bradley & Ekstrom	24 California St., San Francisco	San Francisco	Manganese, chromite, iron ore
Bradley Mining Co.	660 Market St., San Francisco	Stibnite, Idaho	Antimony
Braun Corporation	1363 S. Bonnie Beach Place, Los Angeles	Los Angeles	Quicksilver
Coast Chemical Division, F. W. Berk & Co., Inc.	Sharon Bldg., San Francisco	San Francisco	Quicksilver
Columbia-Geneva Steel Division, U. S. Steel Co.	P.O. Box 269, Salt Lake City, Utah	Geneva, Utah	Manganese and iron ores
International Smelting & Refining Co.	Kearns Bldg., Salt Lake City, Utah	Miami, Ariz.	Copper, gold, silver
International Smelting & Refining Co.	Kearns Bldg., Salt Lake City, Utah	Tooele, Utah	Lead, copper, zinc, gold, silver
Kaiser Co., Inc.	P.O. Box 217, Fontana	Fontana	Iron ore, manganese ore, chromite
Kennecott Copper Corp.	120 Broadway, New York, N. Y.	McGill, Nev.	Copper, gold, silver
Lippincott Lead Mines	Box 1811, Santa Ana	Santa Ana	Lead and zinc ore
Mefford Chemical Co.	5353 Jillson Ave., Los Angeles	Los Angeles	Quicksilver
Pacific Vegetable Oil Co., Bernard T. Rocca	62 Townsend St., San Francisco	San Francisco	Quicksilver
Phelps-Dodge Corp.	40 Wall St., New York, N.Y.	Ajo, Ariz.	Copper, gold, silver
Quicksilver Producers Ass'n., Irving Ballard, Sec'y.	407 Sansome St., San Francisco	San Francisco	Quicksilver
Sullivan Mining Co.	Wallace, Idaho	Silver King, Idaho	Zinc
Twining Laboratories	2527 Fresno St., Fresno	Fresno	Tungsten ore
U. S. Mint	Duboce & Market Sts., San Francisco	San Francisco	Gold, silver
U. S. Smelting, Refining & Mining Co.	Newhouse Bldg., Salt Lake City, Utah	Midvale, Utah	Lead, copper, zinc, gold, silver
Union Carbide Nuclear Co.	30 E. 42d St., New York, N. Y.	Bishop	Tungsten ore
Western Gold & Platinum Works	525 Harbor Blvd., Belmont	Belmont	Gold, platinum, silver*
Wildberg Bros. Smelting & Refining Co.	742 Market St., San Francisco	San Francisco	Gold, platinum, silver*

* Gold and silver in special high-grade ores only.

DIRECTORY OF MERCURY BUYERS

F. W. Berk and Company, Inc.
275 Brannan Street
San Francisco 7, California
(15-25 flask lots)

Braun Corporation
2660 East 15th Street
Los Angeles, California

Buckman Mines
Geysers Road
Cloverdale, California

Chemical Manufacturing Co., Inc., of California
714 West Olympic Boulevard
Los Angeles 15, California

Goldsmith Bros. Smelting and Refining Co.
3918 Foothill Boulevard
Oakland, California

Gordon Gould
58 Sutter Street
San Francisco 4, California

Mefford Chemical Company
1026 Santa Fe
Los Angeles, California

Pacific Vegetable Oil Company
Bernard T. Rocca
62 Townsend Street
San Francisco, California

Quicksilver Producers Association
Irving Ballard, Secretary
407 Sansome Street
San Francisco, California

DIRECTORY OF MINERAL DEALERS AND COMMERCIAL MINERAL PROCESSING PLANTS

List of Mineral Dealers, Custom Mills, and Commercial Grinding Plants in California

Firm	Remarks
American Mineral Co., 840 S. Mission Rd., Los Angeles	Commercial grinding of minerals.
Atkins, Kroll & Co., 417 Montgomery St., San Francisco	Dealer in tungsten ores, mercury, gypsum and limerock.
Baroid Sales Division, National Lead Co., 19301 South Santa Fe Court, Los Angeles	Talc and other soft non-metallic minerals ground by contract or purchased.
Bishop Concentrate & Cleaning Co., Bishop	Custom mill; purchases tungsten ores and base metal ores.
Blood, Harry E., Co., 5028 Alhambra Ave., Los Angeles	Dealer in industrial sand and silica products.
Bradley & Ekstrom, 24 California St., San Francisco 11	Dealer in all commercial minerals.
Brumley-Donaldson Co., 75 Market St., Oakland, and 3050 E. Slauson Ave., Huntington Park	Dealer in sand, clay, limestone, dolomite, and other minerals.
Burton Bros., Rosamond, Kern County	Custom cyanide mill. Gold and silver ores purchased.
Castle Crags Chrome Co., Box 126X, Castella	Dealer in or custom milling of chrome ores.
Commercial Minerals Co., 310 Irwin St., San Francisco 7	Commercial grinding by contract or minerals purchased.
Hidecker Brick Co., Inc., 4054 N. Mission Rd., Los Angeles	Clay grinding plant; non-metallic minerals ground by contract or purchased.
Hill Bros. Chemical Co., 2159 Bay St., Los Angeles	Grinding asbestos, and custom milling of small lots of soft non-metallic minerals.
Huntley Industrial Minerals, P.O. Box 305, Bishop	Dealer in talc, pyrophyllite, garnet sands, clay and mica.
Industrial Minerals & Chemical Co., 836 Gilman St., Berkeley	Non-metallic minerals ground by contract or purchased.
Kennedy Minerals Co., 2556 E. Olympic Blvd., Los Angeles	Non-metallic minerals ground by contract or purchased.
Los Angeles Chemical Co., 4545 Ardine Ave., South Gate	Dealer in non-metallic minerals.
Metals Disintegrating Co., Inc., 1069 Second St., Berkeley 10	Non-metallic mineral grinding by contract or purchase.
Sierra Talc & Clay Co., 1608 Huntington Drive, South Pasadena	Dealer in talc and clays.
Southern California Minerals Co., 320 S. Mission Rd., Los Angeles	Dealer in talc, clay and other minerals.
Twining Laboratories, 2527 Fresno St., Fresno	Purchase and concentrate tungsten ores on a custom basis, also commercial grinding.
Union Carbide Nuclear Co., Bishop	Tungsten mill, ore purchased.
Western Talc Co., 1901 E. Slauson Ave., Los Angeles	Non-metallic mineral grinding plant; minerals ground by contract or purchased.

DIRECTORY OF COMMERCIAL ASSAY AND TESTING LABORATORIES

Firm	Services
San Francisco Area	
American Spectrographic Laboratories, 557 Minna St., San Francisco	Spectrographic analysis of minerals and water by quantitative methods. Radioactivity measurements.
Ball, C. M., 911 University Ave., Berkeley 10	Fire assay, chemical analysis of ores and minerals.
Curtis & Tompkins, Ltd., 236 Front St., San Francisco 11	Chemical analysis and specification testing of metallic ores, metals, and non-metallic minerals.
Hales Testing Laboratories, 4514 Hollis St., Oakland 8	Chemical analysis of metals, cement, ores, minerals, water, X-ray diffraction, X-ray spectrographic analysis, metallurgy, applied research, mechanical and physical testing of structural, industrial, and construction materials.
Hall Laboratories Division, Hagan Chemicals & Controls, Inc., 1485 Bayshore Blvd., San Francisco 24	Consulting water chemists.
Hanks, Abbot A., Inc., 1300 Filbert St., San Francisco	Fire assay, chemical analysis of metals, alloys, cement, ores and minerals; physical tests of structural materials; spectrographic analysis.
Hersey Inspection Bureau, 3405 Piedmont Ave., Oakland	Engineers, chemists, and testers of building materials, foundations.
Metallurgical Laboratories, 604 Mission St., San Francisco 5	Chemical analysis of ceramic materials, chemical analysis of ores and minerals, alloys, spectrographic analysis.
Pacific Chemical Laboratories, 350 Clay St., San Francisco	Chemical analysis of ceramic materials, chemical analysis of minerals, spectrographic analysis, water analysis.
Pittsburg Testing Laboratory, 651 Howard St., San Francisco 5	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals, X-ray-metallurgical examinations, physical tests, spectrographic analysis, water analysis.
Siefert, H. G. Laboratory, 3403 Piedmont Ave., Oakland 11	Chemical analysis of ores and minerals, physical and chemical test of petroleum products, and chemical ceramic testing.
Western Gold and Platinum Works, 525 Harbor Blvd., Belmont	Fire assay, chemical analysis of ores and minerals, ore dressing, benefication.
Western Machinery Co., 650 Fifth St., San Francisco	Ore dressing, mineral benefication, coal washing, sand preparation. Flowsheet determination, plant design and construction.
Los Angeles Area	
California Testing Laboratories, Inc., 619 E. Washington, Los Angeles 15	Chemical analysis of ores, minerals, ceramic materials. Physical, electronic and environmental testing.
Chaney, Albert L. Chemical Laboratory, 1503 E. Chevy Chase Dr., Glendale 6	Microchemistry and trace elements. Quantitative analysis of microgram or smaller quantities.
Dorr-Oliver, Inc., 811 W. Seventh St., Los Angeles 17	Ore dressing, mineral benefication.
Eisenhauer Laboratories, 322 S. San Pedro St., Los Angeles 13	Fire assay, chemical analysis of ores and minerals, ore testing.
Herr Laboratory, 5176 Hollywood Blvd., Los Angeles 27	Fire assay, chemical analysis of ores and minerals, spectrographic analysis, and rare metals chemistry.

DIRECTORY OF COMMERCIAL ASSAY AND TESTING LABORATORIES—Continued

Firm	Services
Los Angeles Area—Continued	
Hollywood Testing Laboratories, 7416 Santa Monica Blvd., Hollywood	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals, ore dressing, benefication, petrographic analysis, physical tests, spectrographic analysis, water analysis, X-ray diffraction, separation of rare earths.
Keldon Research Corp., Box 2555, Terminal Annex, Los Angeles 54	Chemical analysis of ores and minerals, chemical analysis of ceramics; spectrographic analysis, water analysis, mineral evaluation.
Kennard & Drake, 3364 E. 14th St., Los Angeles 23	Chemical analysis of ceramic materials, chemical analysis of ores and minerals, ore dressing, beneficiation, physical tests, spectrographic analysis.
Los Angeles Testing Laboratory, 1300 S. Los Angeles St., Los Angeles 15	Fire assay, chemical analysis, ceramic analysis of ores and minerals, ore dressing, beneficiation physical tests, spectrographic analysis, cargo inspection.
Meco Assayers, 417 S. Hill St., Los Angeles 13	Fire assay, chemical analysis of ores and minerals. Semi-quantitative spectrographic analysis.
Metal Control Laboratories, 2735 E. Slauson Ave., Huntington Park	Chemical analysis of ores, minerals and metals, physical tests, spectrographic analysis, metallurgical examinations, and quantometric analysis.
Minerals Engineering Co., 417 S. Hill St., Los Angeles 13	Ore dressing, beneficiation of ores and minerals, assaying, quantitative spectrographic analysis.
Oilwell Research, Inc., 1539 W. 16th St., Long Beach 13	Clay testing for drilling mud use, water analysis, oil, well core analysis.
Osborne, Raymond G., Laboratories, 235 W. 27th St., Los Angeles 7	Chemical analysis of ores and minerals, physical testing of construction materials.
Petroleum Engineering Associates, Inc., 709 S. Fair Oaks Ave.. Pasadena 2	Spectrographic analysis, water analysis, differential thermal analysis, core analysis.
Quality Control Laboratory, 2606 N. Durfee Ave., El Monte	Fire assay, chemical analysis of ores, minerals, alloys, and water, spectrographic analysis, X-ray diffraction, X-ray fluorescence.
Sill, Harley A., 1011 S. Figueroa St., Los Angeles 15	Fire assay, chemical analysis of ores and minerals, pilot plant testing, ore treatment research.
Smith-Emery Co., 781 E. Washington Blvd., Los Angeles 21	Fire assay, chemical analysis of ceramic materials, chemical analysis of ore and minerals, petrographic analysis, spectrographic analysis.
Triplett & Barton, Inc., 831 N. Lake St., Burbank	Chemical analysis of ores and minerals, spectrographic analysis (rare earth analyses), X-ray diffraction metallography.
Truesdail Laboratories, Inc., 4101 N. Figueroa, Los Angeles 65	Chemical analysis of ores and minerals, physical testing of ferrous and nonferrous metals and alloys.
von Huene, Rudolph, 865 N. Mentor Ave., Pasadena 6	Thin and polished sections prepared.

DIRECTORY OF COMMERCIAL ASSAY AND TESTING LABORATORIES—Continued

Firm	Services
Other Areas	
Calaveras Assay Office, P.O. Box 645, Angels Camp	Fire assay; chemical analysis of ores and minerals, milling tests.
Clarkson Laboratory and Supply, Inc., 1144 30th St., San Diego	Fire assay, Chemical and spectrographic analysis of ores and minerals.
Coast Laboratories, 1859 S. Van Ness Ave., Fresno 15	Fire assays, and chemical analysis of ores and minerals.
Consulting & Testing Laboratories, 607½ E. 18th St., Bakersfield	Chemical analysis of ores and minerals, mining equipment design, mine evaluation, and physical testing of materials.
Engel, Martin C., Cantil	Fire assay; chemical analysis of ores and minerals.
Harrigan, J. F., Laboratory, 541 Hartnell Ave., Redding	Fire assay; chemical analysis of ores and minerals.
Hornkohl Laboratories, 714 Truxton Ave., Bakersfield	Mineral and ore process research, chemical and spectrographic assays of ores; umpire assayers; corrosion and water treatment; testing of petroleum products, muds, oil cores, aggregates, concrete and steel. Concrete coring.
Howard, K. B. Co., P.O. Box 1207, Lindsay	Chemical analysis of ores, minerals, and water chemical and physical test of petroleum.
Mahan's Chemical Laboratory, 5111 Eastside Rd., Redding	Fire assay; chemical analysis of ores, minerals, and water.
Morse Laboratories, 316 16th St., Sacramento	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals, ore dressing, beneficiation, physical tests, spectrographic analysis, chemical and mining engineers.
Peninsula Laboratories, 544 S. San Antonio Rd., Mountain View	Chemical analysis of ores, minerals, and metals; ore and mineral beneficiation, chemical and metallurgical research.
Rombough, M. R. Laboratories, 3069 Del Paso Blvd., North Sacramento 15	Fire assay, quantitative analysis of ores and minerals, testing laboratories and ore beneficiation.
San Joaquin Research Laboratories, Box 1987, 2253 S. El Dorado St., Stockton	Fire assay, chemical analysis of ores and minerals.
Twining Laboratories, 2527 Fresno St., Fresno	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals, ore dressing, petrographic analysis, physical tests, spectrographic analysis, water analysis, X-ray diffraction.
Valley Analytical & Testing Laboratories, Inc., 356 E. Main St., El Centro	Chemical analysis of ores, minerals and water. Engineering materials tests.

METAL, MINERAL, AND MINERAL FUEL REVIEW FOR THE UNITED STATES FOR 1957*

By U. S. Bureau of Mines

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* Presented at the Annual Meeting, Association of American State Geologists, Austin, Texas, April 1, 1958. Published by permission of the Director, U. S. Bureau of Mines, Department of the Interior.

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FOREWORD

Charles W. Merrill, Chief, Division of Minerals

The domestic mining industry failed to experience the growth in 1957 that characterized other postwar years. However, higher unit values for fuels more than offset declines in base-metal prices and lower production for most minerals and resulted in a record high value of $18.3 billion for mineral output. Value of fuels increased 8.7 percent to $12.7 billion; nonmetals rose 1.6 percent to nearly $3.5 billion, and metals declined sharply by 10.6 percent to $2.1 billion. Natural gas and iron ore were the only major commodities to show appreciable production increases.

The Suez Canal closure crisis continued into 1957 and exerted a strong influence on the petroleum industry. Lessened stockpile purchases and agricultural barter for lead and zinc, combined with lower consumer demand forced prices down and led to increased industry stocks. The copper-price decline that had been so abrupt in 1956 continued but at a slower rate. The only serious mineral industries strike was at cement producers.

At the end of 1957 the immediate outlook was less favorable for the mineral industry than at any time since perhaps 1949. Cutbacks in production were widespread, and many planned expansion programs were curtailed or deferred. There seemed little doubt, however, that pressure on mineral raw-material supplies would resume and intensify when the trend of the general economy started upward.

ALUMINUM

R. A. Hindl, Assistant Chief
Branch of Light Metals

Primary aluminum production declined to 1,650,000 tons in 1957 from the record high of 1,680,000 tons produced in 1956. This decrease primarily reflected reduced demand. Increases in stocks at producing plants and shipment by the three major primary producers of over 200,000 tons of metal to the Government under expansion contracts negotiated during the Korean War were other indications of excess of supply over consumption.

At the end of December primary aluminum production capacity in the United States was 1,840,000 tons, an increase of 63,000 tons during the year. This was the result of activation of the first potline at the new Kaiser Aluminum and Chemical Corporation plant at Ravenswood, West Virginia, and installation of a new line at its Chalmette, Louisiana, plant. Early in the year Reynolds Metals Company announced plans to construct a 100,000-ton primary aluminum plant at Massena, New York. In addition, other major reduction facilities were being constructed by Reynolds, Aluminum Company of America, Harvey Aluminum, and Ormet Corporation.

Although the aluminum industry experienced the same slackening as the entire economy, the outlook for this commodity may be brighter than for some competitive materials. Technologic improvements and a steady supply have accelerated acceptance of aluminum in the automotive industry. During the past year the announcement by one producer of the first contract for large-scale production of 1-quart aluminum oilcans was a major breakthrough in the industry's attempt to enter the can market. Other aluminum producers, as well as several container manufacturers, were developing containers and container-producing equipment to use aluminum.

ANTIMONY

H. M. Callaway, Commodity Specialist
Branch of Base Metals

In 1957 the antimony supply-demand position was essentially the same as that of other base metals; that is, supply exceeding consumption by a considerable margin. Although domestic smelter output remained near the 10,000-ton mark of 1956, imports are estimated to have increased more than 20 percent and consumption decreased approximately 20 percent. Government procurement contributed significantly to decreasing the severity of the over-supply.

Total supply of primary antimony available for industrial consumption was approximately 13,200 tons, though only 10,400 tons were consumed.

Imports of metal, oxide, and ore for direct industrial use totaled 7,800 tons and concentrate imported for processing at domestic smelters is estimated to have contained 8,700 tons of antimony. The mines of Mexico, the Union of South Africa, and Bolivia were the major sources of concentrates and the refineries of United Kingdom, Yugoslavia, and Belgium contributed the bulk of refined metal imports.

ARSENIC

A. D. McMahon, Commodity Specialist
Branch of Base Metals

Byproduct recovery of white arsenic in the United States declined to 11,000 tons in 1957 or 10 percent below the 1956 output. Imports rose slightly more than 50 percent to 9,800 tons. Year-end stocks were about the same as those of 1956, reflecting a decrease of about 20 percent in apparent consumption. White arsenic continued to be quoted at $5\frac{1}{2}$ cents a pound.

ASBESTOS

D. O. Kennedy, Assistant Chief
Branch of Construction and Chemical Materials

Asbestos imports were slightly greater in 1957 than in 1956. Over 90 percent of the chrysotile asbestos consumed in the United States (710,000 tons in 1957) came from Canada. Domestic production from mines in Vermont, Arizona, and California supplied less than 6 percent of the chrysotile consumed. Amosite, imported from Africa, and crocidolite from Africa and Australia, raised the total consumption of asbestos by American industries to 750,000 tons in 1957. Chrysotile output in Arizona was sustained by Government purchases under provisions of Public Law 733.

BARITE

A. E. Schreck, Commodity Specialist
Branch of Construction and Chemical Materials

Domestic production of barite in 1957 was below the record high of 1.3 million tons established in 1956, but imports appeared to have set a new high. Oil-well drilling was again the largest market for ground barite.

Arkansas remained the leading producing state; Missouri was second, Georgia third, and Nevada fourth. Production was also reported in California, Idaho, Montana, New Mexico, South Carolina, and Tennessee.

A new firm came into production in 1957 in Cherokee County, South Carolina. Other firms planned to start mining in Marion County, Kentucky, and near Bernalillo, New Mexico. Discovery was reported of a large barite deposit near Austin, Nevada. In Kansas construction of additional barium chemical facilities was begun.

Although domestic production of barite declined in 1957, the outlook for the industry appeared bright. The oil-well drilling industry is expected to remain the largest consumer, and increased use of barite in concrete aggregate and titanate ceramics is anticipated.

BAUXITE

R. C. Wilmot, Commodity Specialist
Branch of Light Metals

The 1.4 million tons of bauxite produced in the United States in 1957 represented a decrease of 19 percent from the previous year. Arkansas produced about 96 percent of the total; the remainder came from Alabama and Georgia. Imports are estimated at 7.1 million tons and comprised 83 percent of the total supply. Haiti, a new source of supply for the United States, began commercial production in the second quarter of 1957.

Alumina plant capacity in operation decreased about 5 percent to 3,355,000 tons. The drop was caused by closing in November of the East St. Louis, Ill., plant of the Aluminum Company of America. The laboratory and cryolite plant at the same site were not affected.

Although 1.7 million tons of new alumina capacity, all to use imported bauxite, was under construction at the beginning of the year, the more ample supply of aluminum had diminished the sense of urgency, and as a result some completion dates were deferred. However, Reynolds Metals Company started production at a new 183,000-ton unit at its La Quinta, Texas, plant, bringing the annual alumina capacity there to 548,000 tons. A 430,000-ton Kaiser Aluminum and Chemical Corporation plant at Gramercy, Louisiana, originally scheduled for completion in midyear, had not been completed at year's end. Construction on the Alcoa plant of 750,000-ton capacity at Point Comfort, Texas, originally scheduled for completion in 1958, was slowed at year's end. Ormet Corporation proceeded with the construction of a 350,000-ton alumina plant at Burnside, Louisiana, which was scheduled for completion in the first part of 1958.

Interest grew in foreign bauxite-producing regions as sites for alumina plants and aluminum-reduction plants. Several firms were investigating or had plans to build in French West Africa, the Cameroons,

and the Congo. In the Western Hemisphere, Aluminum Company of America signed letters of intent that envision the construction of an integrated bauxite, alumina, aluminum industry in Surinam.

Exploration of Australian bauxite deposits continued in 1957. Besides Cape York Peninsula, the investigation was extended west to Arnhemland. Reynolds Pacific Mines Pty. and Aluminum Laboratories, Ltd., both obtained concessions in the new area.

BERYLLIUM

Donald E. Eilertsen, Commodity Specialist
Branch of Rare and Precious Metals

In 1957 United States production of beryl is estimated to have totaled 600 short tons, consumption 4,600 tons, and imports 7,300 tons. Prices were about the same as in 1956: $514 a ton for domestic beryl, and $360 a ton for imported beryl.

Two new plants were constructed to produce beryllium: one at Hazelton, Pennsylvania, by The Beryllium Corporation of Reading, Pennsylvania, and the other at Elmore, Ohio, by the Brush Beryllium Company of Cleveland, Ohio. Each plant will produce 50 tons of reactor-grade metal annually over a 5-year period for the Atomic Energy Commission at approximately $47 a pound.

The Bureau of Mines continued its research on recovering low-grade beryl from pegmatites. Results of Bureau research on beryl flotation are promising, but more research is being done to simplify and improve procedures.

BISMUTH

H. M. Callaway, Commodity Specialist
Branch of Base Metals

Although consumption of bismuth metal increased 10 percent, the total supply exceeded demand, owing to decreased barter acquisitions by the Department of Agriculture in 1957.

Imports of metal were 885,000 pounds, 4 percent under the 1956 figure. Based on the rate of consumption during the first 9 months, consumption in 1957 is estimated at 1,680,000 pounds.

Several potential new uses for this metal are being investigated and will possibly cause further expansion of the industry.

BITUMINOUS COAL AND LIGNITE

T. Reed Scollon, Chief
Division of Bituminous Coal

Bituminous coal and lignite production in 1957, estimated at 490 million tons, was down 2.2 percent from 1956. Consumption for electric power generation, coal's largest single market, continued upward but at a lesser rate than in recent years. Aside from a recovery of coal consumption at coke ovens to the 1955 level, the domestic market for bituminous coal and lignite dropped sufficiently to effect a net decline of 19 million tons (4.4 percent) during the year. Exports, on the other hand, reached their highest level in history. Although shipments to Canada dropped over 2 million tons, overseas exports increased to 58 million tons, of which approximately 50 million tons went to Europe.

In Bureau of Mines studies of the underground gasification of coal, hydraulic fracturing of the coal bed by using a water-gel and sand mix promised greater permeability than previously achieved.

In cooperation with the Atomic Energy Commission, the Bureau of Mines began investigating design, construction, and operation of a pressurized simulated nuclear reactor to gasify coal. The primary objectives at this time are to test equipment components and to develop high-pressure gas technology.

On a worldwide basis, two of the major technological advancements during 1957 were the completion of the Pittsburgh Consolidation Coal Company pipeline in the United States to transport large quantities of coal over a considerable distance, and coming on stream of the SASOL Fischer-Tropsch plant for producing liquid fuels from South African coal.

BORON

Henry E. Stipp, Commodity Specialist
Branch of Construction and Chemical Materials

Boron received much attention in 1957 as an ingredient in high-energy "exotic" fuels. Use of boron compounds in jet and rocket fuels may increase performance efficiency by as much as 50 percent. Development of such fuels can be an important contribution to technical progress in this vital field. Substantial facilities for the production of boron fuels were being built.

Production of boron minerals in 1957 approximated 950,000 short tons with a B_2O_3 content of about 316,000 short tons and a value of about $40 million. Mining and processing capacity of the boron industry was increased by completion of the new open-pit mine and refinery of the U. S. Borax and Chemical Corporation at Boron, California.

CADMIUM

Arnold M. Lansche, Commodity Specialist
Branch of Base Metals

Cadmium metal in 1957 was obtained as a byproduct from processing and smelting zinc concentrate and from flue dust from Mexico. Production totaled approximately 10.4 million pounds, about the same as in 1956. Total new supply was nearly 11.9 million pounds, exceeding apparent consumption by 9 percent. Shipments by metal producers, including those for internal consumption, were 9.8 million pounds in 1957, 10 percent below the 1956 level. Total metal stocks at the end of the year were about 7 percent above those on hand at the end of 1956. General imports of metal were about 1.65 million pounds, most of which came from Canada; approximately 1.67 million pounds of flue dust (cadmium content) come from Mexico. Nearly 696,000 pounds of United States cadmium was exported during the year.

CARBON BLACK

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

Carbon black production in 1957 was 1,801 million pounds, a 2.1 percent decrease for the year. Stocks at year's end totaled 339.4 million pounds, an increase of 1.5 million.

CEMENT

D. O. Kennedy, Assistant Chief
Branch of Construction and Chemical Materials

After 12 years of continuous growth, production of portland cement in the United States decreased from 316.4 million barrels in 1956 to 297.8 million barrels in 1957.

Strikes in the building-construction industry on the Pacific coast and at cement plants east of the Mississippi were the principal causes for the drop in cement production. Demand was partly met by imports.

Plant capacities increased to 364 million barrels, a gain of 15 percent in 1957, but 17 million short of the expected 381-million-barrel capacity forecast in 1955.

Most representatives of the cement industry expressed optimism in the future based on projected increases in general construction for 1958, and did not feel that the decrease in cement production in 1957 was indicative of the future.

CHROMIUM

Wilmer McInnis, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

United States imports of chromite ore and concentrate during 1957 were higher than in any preceding year. Preliminary data indicated total imports for the year were about 2.3 million short tons of which over 60 percent was metallurgical-grade ore, about 25 percent refractory-grade ore, and the remainder chemical-grade ore. The metallurgical-grade chromite was obtained principally from the Federation of Rhodesia and Nyasaland, and Turkey; refractory-grade chiefly from the Philippines; and chemical-grade from the Union of South Africa.

Domestic chromite production (shipments) totaled about 163,000 tons, all of which was sold to the Government at incentive prices. The Mouat mine in Montana was the source of over two-thirds of this output and the remainder was from mines in California, Oregon and Alaska.

Domestic consumption of chromite decreased in 1957. Through November the metallurgical industry used about 1 million tons of chromite ore and concentrate averaging 46.9 percent Cr_2O_3 in the manufacture of 446,000 short tons of chromium alloys and chromium metal and about 21,000 tons in direct addition to steel. In the same period, 406,000 tons of 34.7-percent Cr_2O_3 ore was used in refractory products and 133,000 tons of 45-percent ore was consumed in the manufacture of 97,000 tons of chromium chemicals.

Industry stocks of chromite increased to nearly 1.6 million tons by the end of November, equivalent to about 11-months' supply. Chromium-ferroalloys and chromium-metal stocks at producers' plants on November 30 were up 31 percent from the close of 1956.

World mine production of chromite in 1957 decreased somewhat due to lower output in the Philippines, Turkey, and The Union of South Africa. Production in the Federation of Rhodesia and Nyasaland during the first half of 1957 was at a higher rate than during the period in 1956.

CLAYS

Brooke L. Gunsallus, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Although total production of all types of clays decreased an estimated 5 percent in 1957 from the 1956 figure of 50.9 million tons, output of clay and shale for making thermally expanded lightweight aggregate (which had increased by 34 percent in 1956 over 1955) increased 10 percent. The outlook is for continued rapid expansion of lightweight aggregate production.

COBALT

Hubert W. Davis, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

World production of cobalt declined to about 15,500 short tons in 1957 and reversed a 7-year uptrend. Production was 3 percent less than in the record year of 1956 but nevertheless was the second highest. However, the smaller output exceeded requirements. Record outputs were made in Canada and the United States, and production in Northern Rhodesia was the highest since 1940. Belgian Congo continued as the chief producing country, but output was less than in 1956.

Although the United States continued to depend upon foreign sources for much of its cobalt in 1957, domestic mines furnished a larger proportion than in any other year. A record of 4.1 million pounds, equal to 3.3 million pounds of recoverable cobalt, was produced from domestic mines in 1957, compared with 3.6 million pounds, equal to 2.5 million pounds, in 1956. Thus, domestic mine production in 1957 was equivalent to 36 percent of the cobalt consumed in the United States, compared with 27 percent in 1956.

Bethlehem Cornwall Corporation in Pennsylvania, Calera Mining Company in Idaho, and National Lead Company in Missouri continued to produce cobalt concentrates from domestic ores.

Consumption of cobalt in the United States is estimated at 9.2 million pounds in 1957, compared with 9.6 million pounds in 1956. Imports are estimated at 17.5 million pounds, compared with 15.6 million pounds in 1956. Noteworthy was the receipt of 1,613,000 and 530,000 pounds of metal from the United Kingdom and the Federation of Rhodesia and Nyasaland, respectively; the metal was acquired in exchange for surplus agricultural commodities.

The price of cobalt metal and oxide was reduced 35 cents a pound to $2 and $1.43 respectively, on February 1, 1957. This reduction followed one of 25 cents on December 1, 1956.

COLUMBIUM (NIOBIUM) AND TANTALUM

William R. Barton, Commodity Specialist
Branch of Rare and Precious Metals

Domestic production of columbium-tantalum concentrate was at a record high in 1957. Porter Bros. Corporation increased output severalfold from a euxenite-columbite-monazite placer at Bear Valley, Idaho. Foreign concentrate production and United States imports decreased for the second year due to the United States Government's absence from the market for foreign ores.

Industrial demand continued strong and metal production started at new facilities at Muskogee, Oklahoma, Albany, Oregon, and Niagara Falls and Glen Cove, New York. High-purity commercial columbium was reported at a new low price of $55-$80 a pound.

The Bureau of Mines published a report on low-temperature chlorination of columbium-bearing Arkansas titanium deposits. The process should prove applicable for most submarginal titanium deposits containing other valuable minor constituents such as columbium and iron.

An unusual ore body studied in Ravalli County, Montana, contains columbite and an exotic calcium columbate mineral with rare earths in a carbonate rock. This deposit, controlled by Continental Columbium Corporation, may prove to be the first domestic columbium source of this type.

The growing demand for columbium and tantalum is expected to continue in 1958. Columbium is gaining importance as an ingredient in high-temperature alloys used in supersonic aircraft, missiles, gas turbines, and in atomic reactors. Tantalum is highly favored in electronic components for high-temperature service and corrosion-proof equipment, and is finding experimental use in nuclear reactors.

COPPER

A. D. McMahon, Commodity Specialist
Branch of Base Metals

Production of recoverable copper in 1957 from domestic mines decreased 3 percent from 1956. Refinery output from domestic sources dropped 3 percent, that from foreign sources increased 11 percent, and the total from both sources remained about the same as in 1956. For January through November, consumption of refined copper fell 11 percent; total imports of copper rose 2 percent and exports of refined copper were up 75 percent compared with the same period in 1956. Stocks of refined copper at primary refineries were 26 percent more than at the end of 1956.

The continuing imbalance between supply and demand for copper in 1957 forced the price of electrolytic copper produced domestically from the year-opening quotation of 36 cents a pound to 27 cents by early September. The 36-cent quotation, established October 29, 1956, held until February 1, 1957; then four successive drops lowered it to 32 cents by February 19. Further cuts in June, August, and early September brought it to 27 cents. Prices quoted by United States custom smelters were 1 to 2 cents lower, and foreign market prices were as much as 5 cents a pound lower. The frequent price cuts and the announced curtailments of production failed to encourage the increase in demand needed to stabilize or effect an upturn in the market.

CRUDE PETROLEUM

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

Crude petroleum production in the United States in 1957 reached a record high rate of 7,175,000 barrels daily, with an estimated average value of $3.10 a barrel at the well.

The demand for petroleum products, while showing a slight gain for the year, did not maintain the rate of increase that has come to be expected in recent years. Following the reopening of the Suez Canal in April, stocks of crude oil and products built up steadily and at the close of the year were 50 million barrels higher than at the close of 1956.

Imports of crude oil averaged 997,000 barrels daily in 1957, a 6.7 percent increase over 1956. A Federal Government voluntary program to restrict imports was in effect during the latter half of the year.

DIAMONDS (INDUSTRIAL) AND SUBSTITUTES

Henry P. Chandler, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

World production of industrial diamonds during 1957 was estimated at 19 million carats, compared with 18.3 million carats in 1956. Imports into the United States during 1957 were estimated at 12 million carats, valued at approximately $67 million, a reduction of nearly 4 million carats from 1956.

During 1957 the General Electric Company offered its manufactured diamonds for sale at $3.48 a carat in lots of 10,000 carats or more, compared with about $2.80 a carat for similar natural material. Tests indicated that manufactured diamonds are equal in work value to the natural material for most uses.

FELDSPAR

Taber de Polo, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Additional feldspar production capacity completed late in 1957 led to drops of 15 to 20 percent in prices of certain grades of ground feldspar. The tonnage of feldspar sold in 1957 was about the same as in 1956.

Spar-Mica Corporation, Ltd. began to ship crude feldspar from its newly opened Cape Feldspar mine at Baie Johan Beetz, Quebec, Canada, to Camden, New Jersey, for grinding. Reserves are large. Lawson United Feldspar Corporation completed a plant at Spruce Pine, North Carolina, with a capacity of 8,000 tons a month to produce feldspar from a large alaskite deposit. Other major companies also expanded facilities. Substantial quantities of feldspar continued to be recovered from beach and river sands, mostly for use in glass. The Golding-Keene Company, Keene, New Hampshire, began using a patented process to concentrate feldspar by magnetic separators and electrostatic machines.

Imports from Canada of nepheline syenite, the principal substitute for feldspar, increased about 20 percent during the year. Competition continued from lower priced aplite and slag for use in making amber glass and window glass.

Excess feldspar production capacity should be absorbed in the next few years by growing demand, despite increased competition from substitute materials.

FLUORSPAR

R. B. McDougal, Commodity Specialist
Branch of Construction and Chemical Materials

Fluorspar consumption reached a new high in 1957 and imports increased substantially while domestic production remained about equal to the previous year's output.

Production of finished fluorspar in the United States totaled about 325,000 tons in 1957 with a value of approximately $15.5 million. Illinois again was the leading state, shipping slightly over half the total. Colorado and Montana supplied about two-thirds of the balance; Kentucky, Nevada, and Utah supplied the remaining third.

Several important changes occurred in the industry during the year. The Kaiser Aluminum and Chemical Corporation closed its mine near Gabbs, Nevada, early in the year owing to ore depletion, and its mill at Fallon was placed on standby status in September. Quo Vadis Mines, Inc., purchased the Bell Hill Mining Company fluorspar property in Juab County, Utah, and built a flotation mill at Delta to upgrade the local ore to acid grade. In mid-November the Mackey-Humm Fluorspar Mining Company and Hicks Creek Mining Company, two Illinois producers, were purchased by H. Evans Roberts, partner in the Montana operation near Darby, who plans to construct a flotation mill for the production of acid-grade fluorspar.

Prices, which had begun to improve during the summer and fall of 1956, remained fairly stable throughout 1957. Quotations from trade journals on Mexican fluorspar indicated a slight decline during the year. European fluorspar was quoted at near domestic prices in 1957.

Fluorspar consumption is estimated to have reached a new record of nearly 660,000 tons in 1957, of which 320,000 tons was used to produce hydrofluoric acid, as compared with 289,500 tons so used in the previous year. Some acid-grade fluorspar was consumed by the glass and enamel industries. Approximately 40,000 tons of ceramic-grade fluorspar was used at glass and enamel plants and in other applications such as special fluxes. Steel plants consumed about 268,000 tons of fluorspar in the production of steel, a slight increase from 264,000 tons in 1956. Iron foundries used about 15,000 tons.

Purchases of acid-grade fluorspar under Public Law 733 and of metallurgical grade fluorspar for the strategic stockpile helped maintain the volume of domestic output during the year.

Continued growth in the markets for fluorspar was anticipated by the industry, but less optimism was expressed regarding the trend of domestic production.

GOLD

J. P. Ryan, Commodity Specialist
Branch of Rare and Precious Metals

Continuously declining domestic gold production, in contrast to the steadily rising world production, was the most significant feature of the gold-mining industry in 1957.

Domestic mine production of recoverable gold in 1957 was 1.77 million ounces, a 3 percent drop from the preceding year and, except for the war years 1943-46, was the lowest since 1893. South Dakota again led in production, followed by Utah, Alaska, and California, the same as in 1956. These three states and one territory accounted for 75 per-

cent of domestic output. About 60 percent of domestic gold came from straight gold mining operations; the remaining 40 percent was recovered as a byproduct of base-metal mining and smelting. Net imports of gold in 1957 aggregated $81.4 million, 24 percent less than in 1956. Treasury stocks of gold rose $832 million during the year to $22,781 million.

Expansion of output in the Union of South Africa continued in 1957 and world production of gold increased for the fourth successive year to an estimated 39.5 million ounces. The Union of South Africa accounted for about 45 percent of the world output of gold. The Soviet Union, Canada, and the United States were the other leading gold-producing countries.

United States Treasury price of gold remained at $35 an ounce. Rising operating costs continued to force some domestic mines to close and others to curtail operations. The remarkable expansion of output in South Africa was not indicative of any improvement in gold-mining conditions generally, but rather of the continued development of new mines in the Orange Free State and to the recovery of uranium associated with the gold ores. Gold mining in Canada, Australia, and the Philippines continued to receive financial assistance through Government cost-aid subsidies; in South Africa tax concessions aided several mine operations.

New applications for gold developed in 1957 included: Gold coatings for aircraft engine shrouds for protection against heat and corrosion; gold plating of earth satellites to facilitate optical tracking and to provide protection from corrosion and heat; radioactive gold in the treatment of cancer; and gold ceramic coatings in architectural panels.

GRAPHITE

Donald R. Irving, Assistant Chief
Branch of Ceramic and Fertilizer Materials

In 1957 all types and grades of natural graphite were in plentiful supply, and consumption remained at about the 1956 level. During the year, purchases of 97/98 percent carbon Ceylon amorphous lump graphite for the national stockpile stopped when the inventory substantially equalled the minimum objective.

With completion of national stockpile objectives for all grades of graphite, the Department of Defense ruled there was no need to retain the Government-owned Benjamin Franklin graphite mine and mill near Chester Springs, Pennsylvania, and the property was sold.

Southwestern Graphite Company, Burnet, Texas, (high-grade flake graphite), and Graphite Mines, Inc., Cranston, Rhode Island, (low-grade amorphous graphite) were the only domestic producers, although amorphous graphite in Mexico was produced by subsidiaries of United States companies.

No new uses requiring large quantities of natural graphite were reported, and no substantial increase in consumption is foreseen.

GYPSUM

Leonard P. Larson, Commodity Specialist
Branch of Construction and Chemical Materials

Due primarily to a decline in residential construction, gypsum output was lower in 1957 than in the preceding year. The decline in resi-

dential construction was partly offset by a 10 percent increase in the construction of public works such as schools, highways, sewers, and water facilities.

Based on the domestic mine production total of 6.8 million short tons during the first 9 months of the year, the total output of crude gypsum during 1957 was about 9 million short tons. Consumption of most categories of gypsum building products, particularly high-value prefabricated materials, followed the downward trend of residential construction.

Although no major increases in the output of gypsum products are anticipated, the Bureau of Mines expects that the output of gypsum products in 1958 will be higher than in 1957.

HELIUM

Henry P. Wheeler Jr., Chief
Helium Liaison Office

Helium consumption continued upward to reach a new peak of 310 million cubic feet in 1957. The Bureau of Mines was the only producer of this inert lightweight gas from two plants in Texas, one in Kansas, and one in New Mexico. Despite record production, the supply during the year was not adequate to meet all requirements. Defense and medical needs were met, but some less essential activities were unable to obtain as much helium as they desired. The Bureau expects that the recent enlargement of its Exell, Texas, plant will relieve the shortage somewhat in 1958. The gain may be short-lived, however, due to anticipated new demands for helium in defense and atomic-energy programs.

IRON ORE

Horace T. Reno, Assistant Chief
Branch of Ferrous Metals and Ferroalloys

United States iron-ore production in 1957 totaled 105 million long tons, nearly 8 percent more than in 1956. Iron-ore imports increased nearly 10 percent, and despite a slight decline in steel production, 1957 blast-furnace pig-iron output reached a record high of 78.6 million net tons.

The Lake Superior district continued by far the principal domestic iron-ore producer with 79 percent of the total. The Western States produced 9 percent of the total, the Southeastern States 6 percent, the Northeastern States 5 percent, and iron-ore produced as a byproduct in all districts accounted for the remaining 1 percent.

Iron-ore production for export in foreign countries in 1957 appeared to slow somewhat, but nearly 25 percent of the iron ore consumed in the United States in 1957 was imported.

The average grade of ore consumed continued to rise. In the Lake Superior district, the Marquette Iron Mining Company produced high-grade iron ore pellets from Michigan jaspilite. The Reserve Mining Company produced more than 5 million tons of high-grade pellets from taconite at Silver Bay, Minnesota, and Minnesota's second large-scale taconite plant operated by Erie Mining Company began production in 1957.

With the 1957 all-time record production of 78.6 million short tons of pig iron, blast-furnace consumption of iron ore and iron-bearing agglomerates reached a new high of 135.5 million short tons. However, total consumption of these materials did not set a new record because of lower steel output and higher iron content of blast furnace feed.

LEAD

O. M. Bishop, Commodity Specialist
Branch of Base Metals

Until early May 1957 good industrial demand, supplemented by United States Government barter and "long-term stockpile" acquisitions, stimulated mine and smelter production and served to stabilize the price of common lead at 16 cents a pound, New York City. At that time the Government announced the temporary cessation of further barter contracts and the near attainment of the strategic stockpile goal for lead.

Thereafter industrial demand in the United States declined and new barter contracts did not absorb excess foreign lead stocks, which continued to be imported. Although many domestic mines closed or curtailed production, supplies continued in excess and by December 2 the price of refined (common) lead had fallen to 13 cents a pound f.o.b. New York City.

Domestic mine production of recoverable lead declined from an annual rate of 360,000 tons in the first quarter of 1957 to 300,000 tons in the last quarter and totaled 333,000 tons for the year, compared with 353,000 tons in 1956. Imports of lead as pig metal, bullion, and ore totaled 510,000 tons and secondary lead accounted for 500,000 tons. Domestic mine output, secondary sources, and imports together provided 1,340,000 tons of lead in 1957. Total industrial consumption was 1,145,000 tons.

Among the important lead mines closed were the San Xavier, Athletic, and Trench in Arizona, the Darwin mine in California, the Keystone, Rico-Argentine, and Resurrection in Colorado, the Triumph and Nabob in Idaho, Combined Metals Company Pioche operation in Nevada, the Groundhog in New Mexico, the Eagle-Blue Bell, Chief No. 1, Plutus, Mayflower-Park Galena in Utah, and the Eagle-Picher mines in Oklahoma and Kansas. The Anaconda Company curtailed output at its Butte, Montana, mines and the Bunker Hill and Day mines of the Coeur d'Alene region of Idaho cut back from a 6- to a 5-day week.

LITHIUM

A. E. Schreck, Commodity Specialist
Branch of Construction and Chemical Materials

Production and consumption of lithium minerals and compounds continued to increase in 1957 and emphasis was on the development of new markets. Lithium minerals were produced in North Carolina and South Dakota and dilithium sodium phosphate was produced from the brines of Searles Lake, California.

Some of the secrecy that surrounded the lithium industry the past several years was relaxed when the Atomic Energy Commission revealed it had contracted with three lithium producers for lithium hydroxide.

A Canadian supplier of lithium concentrate announced plans for a lithium chemical plant near Rouses Point, New York. Lithium metal production facilities in North America were expanded when one Canadian and one domestic firm began metal production.

The American Lithium Institute, in its first year of operation, sponsored research on the use of lithium in glass, in lithium alloys, and as a polymerization catalyst.

The outlook appears to be one of increased consumption in established uses, and continued research on new uses with emphasis on uses for lithium metal.

MAGNESIUM
(INCLUDING MAGNESIUM COMPOUNDS)

H. B. Comstock, Commodity Specialist
Branch of Light Metals

Production of primary magnesium in the United States in 1957 was 81,263 tons, the highest since the close of the Korean War. As in 1956, the metal came from the two electrolytic plants at Freeport and Velasco, Texas, and the small silicothermic plant at Canaan, Connecticut. The purchase of the Government-owned Velasco plant by the Dow Chemical Company, which had leased it since 1951, was announced November 4.

Estimated domestic consumption of magnesium for 1957 was approximately 12 percent below 1956, due primarily to the decreased use as a reducing agent to produce other metals, and as an alloying constituent with other metals. During the year improvements in casting, fabricating, joining, and finishing were reported, pointing toward new structural applications of magnesium in the near future. The base price of primary magnesium ingot remained at 35.25 cents a pound throughout 1957.

During the first 9 months of 1957, magnesium imports in all forms were 898 tons, a rise of 37 percent above those for all of 1956.

Exports for this period of 1957 were 1,364 tons or 62 percent below those for the first nine months of 1956. On June 30, 1957, duty on magnesium pig and alloys fell from 17.2 cents a pound to 14.3 cents; and on the magnesium content of powder, sheets, tubing, manufactures, etc., duty dropped from 19 cents a pound (plus 10 percent ad valorem) to 18 cents a pound (plus 9.5 percent ad valorem).

Production of the principal magnesium materials—magnesite, dolomite, and olivine, and their use in basic refractories, increased substantially in 1957. The expansion of refractories facilities, begun in 1956, continued in 1957. Rising demands in the refractories, paper, rubber, textiles, and chemicals industries resulted in the output of 7 percent more magnesium oxide from sea water and well brines than in 1956.

MANGANESE

G. L. DeHuff Jr., Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

Preliminary figures for domestic maganese ore, concentrate, and nodule production containing 35 percent or more manganese indicate a total for 1957 of 365,000 short tons, a record high.

Nodules produced by Manganese, Inc. at Henderson, Nevada, and by The Anaconda Company in Montana provided half of this quantity. Of the remainder, producers in Arizona, New Mexico, and California shipped approximately 100,000 short tons under the Government's "carlot" purchase program—just about double that shipped by Arkansas, Virginia, and Tennessee under the same program. A relatively small quantity of battery concentrate was produced by Trout Mining Division, American Machine and Metals, Inc. at Philipsburg, Montana; Manganese Chemicals Corporation produced synthetic battery ore and high-purity manganese carbonate from low-grade Cuyuna range materials at Riverton, Minnesota.

Receipts by the Government of low-grade manganese ores, under its Butte-Philipsburg domestic manganese-purchase program, were at an accelerated rate over those in 1956. Because of the low-grade and off-grade nature of these ores, they will not be reported as production until shipped to consumers.

Perhaps the most significant features of the year were the beginning of imports of high-quality ore from the Amapa region of Brazil, and the large tonnage acquired during the year from that source. Total United States imports of manganese ore in 1957 reached 3 million short tons, the greatest of any year except 1953. Brazil, India, Ghana, Union of South Africa, and Mexico were the principal supply sources in that order. Approximately 200,000 short tons of ferro-manganese also was imported. Consumption of manganese ore was again a record, totaling approximately 2,350,000 short tons. Industrial ore stocks increased somewhat to approximately 1½ million short tons.

Prices for Indian ore of 46 to 48 percent manganese content dropped gradually to close the year quoted nominal $1.36-$1.39 a long-ton unit (c.i.f. U. S. ports, import duty extra, export duty included). Prices for Government purchases of domestic ore under the domestic manganese-purchase program remained based at $2.30 a long-ton unit.

MERCURY

James W. Pennington, Assistant Chief
Branch of Base Metals

Domestic mercury production in 1957 increased nearly 40 percent over 1956 as significant gains at mines in Alaska, California, Nevada, and Oregon raised primary output to an estimated 33,500 76-pound flasks.

Industrial consumption of mercury continued high and probably equalled the 54,000 flasks used in 1956. Expansions at chlorine and caustic soda plants using mercury cells were largely responsible for the high consumption.

Mercury imports lagged behind 1956 and fell to an estimated 45,000 flasks. Prices also declined and ranged from $255-$257 a flask in the beginning to $225-$230 a flask at the end of the year. The average price of $247 a flask was $13 less than 1956.

MICA

Milford L. Skow, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Domestic production of muscovite mica for sale to General Services Administration was equivalent to 2,700 short tons of hand-cobbed mica.

Sales of domestic punch mica to industry dropped to about 300,000 pounds, and sales of ground mica remained near the 1956 level of 91,000 short tons. Imports of block and film were about 20 percent lower than in 1956, but imports of splittings increased as a result of the barter of agricultural commodities for strategic materials.

Because of the lower level of industrial activity and the increasing use of ceramic materials in place of nonstrategic sheet mica in electrical appliances, the fabrication of block and film mica was about 15 percent less than in 1956. Production of mica paper from natural mica scrap continued to increase moderately and flake synthetic mica found increasing use in glass-bonded mica ceramic products.

MOLYBDENUM

Wilmer McInnis, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

Domestic production of molybdenum in 1957 increased 6 percent over 1956. Output was from the Climax mine in Colorado and from byproduct sources in Utah, Arizona, California, New Mexico, and Nevada. The increase in output came largely from Climax, where a new milling unit began operating in February. This enabled the company to treat more than 10 million short tons of ore during the year. Curtailed operations at some copper mills resulted in lower molybdenum recovery from these sources.

A Materials Survey on molybdenum was published by the Bureau of Mines (Information Circular 7784). It gave the molybdenum reserve of the United States and Alaska as 2.2 billion pounds. These reserves are in ores containing over 0.50 percent molybdenite and in copper and tungsten ores containing molybdenite recoverable commercially as a byproduct.

Consumption of molybdenum contained in concentrate during 1957 was estimated at about 39 million pounds, compared with nearly 42.7 million pounds in 1956. The decrease was due largely to a strike that closed the Climax conversion plant at Langeloth, Pennsylvania, during the last half of the year. About 30 million pounds of molybdenum contained in primary products was consumed in the United States. Of this, 86 percent was added to iron and steel alloys, 6 percent was used in special high-temperature and corrosion-resistant alloys, and the remainder was used as metal or compounds.

Molybdenum exports continued the upward trend that has persisted since 1951. The major importing countries were West Germany, United Kingdom, Sweden, Japan, and Canada.

World production, of which over 90 percent was from the United States, is estimated to have increased. Known foreign production was largely confined to Chile, Canada, Norway, and Japan; Union of Soviet Socialist Republics and some of its satellite countries were believed to have produced substantial quantities of molybdenum in 1957. Output in Chile was recovered as a byproduct of copper ore from the Braden mine, but a molybdenum-recovery unit at the Chuquicamata copper mine was believed ready for operation at year's end.

NATURAL GAS

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

Continuing its steady increase, the marketed production of natural gas in the United States is estimated at 10,688 billion cubic feet in 1957. The average value at the wellhead is estimated at 11.2 cents a thousand cubic feet, 0.4 cents higher than in 1956.

NATURAL-GAS LIQUIDS

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

Natural-gas liquids production and value for 1957 remained about the same as in 1956 (12,350 million gallons valued at $704 million). Liquefied petroleum gas production and value showed slight increases for the year.

NICKEL

Hubert W. Davis, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

Except for brief periods, the availability of nickel since mid-1957 exceeded demand for the first time since 1942. The improved supply-demand position resulted principally from increased production, virtually complete stockpile deferments, and decreased requirements in the United States. Nevertheless, intense activity continued in exploring for new sources, developing new mines, and planning new and expanding present smelting and refining facilities.

The uptrend in free-world production continued for the seventh consecutive year in 1957 and totaled about 248,000 short tons. Although domestic production, chiefly in Oregon and Missouri, increased 50 percent over 1956 to establish a new record of about 10,000 tons, it represented only about 8 percent of consumption (125,000 tons) in the United States in 1957. Production in 1957 at the U. S. Government-owned plant at Nicaro, Cuba, where a 75-percent expansion of the nickel-producing facilities was completed in March 1956, was 38 percent greater than in 1956.

The Government entered into an agreement with Cuban American Nickel Company, a subsidiary of Freeport Sulphur Company, to buy up to 271 million pounds of nickel metal. Construction of facilities was under way at Moa Bay, Cuba, where the company will produce a high-grade nickel-cobalt concentrate. It will be shipped to Breithwaite, Louisiana, where a refinery with an annual capacity of 50 million pounds of nickel metal will be built to reduce the concentrate.

International Nickel Company of Canada, Ltd., made much progress in developing its property in the Mystery-Moak Lakes area in northern Manitoba. By 1960, the company expects to have there a capacity to produce 75 million pounds of nickel annually; this will be the second-largest nickel-mining operation in the free world.

During 1957 the contract price to United States buyers of electrolytic nickel in carlots f.o.b. Port Colborne, Ontario, remained unchanged at 74 cents a pound, including duty of $1\frac{1}{4}$ cents.

PENNSYLVANIA ANTHRACITE

J. A. Corgan, Chief
Division of Anthracite

Pennsylvania anthracite production in 1957 resumed its post-World War II downward trend, following a rise in 1956. Output is estimated to have fallen off approximately 12 percent to 25.5 million net tons, valued at $212 million. The overall decline in 1957 resulted from a reduction of approximately 13 percent in apparent consumption within the United States and a 17 percent decline in exports. Exports to Canada fell 25 percent below 1956 owing primarily to competition from natural gas which was introduced into eastern Canada late in 1956.

PERLITE

L. M. Otis, Commodity Specialist
Branch of Construction and Chemical Materials

The Bureau of Mines estimates that domestic production of crude perlite in 1957 changed little from 1956. The use pattern for expanded perlite also was about the same as in 1956 when 76 percent of output went into plaster aggregate and 10 percent into concrete aggregate. From 1950 to 1957 total perlite sales have grown steadily each year, but the growth rate was slower in 1956-57. The use of expanded perlite as a filter aid probably increased in 1957. This market is important to the industry as it provides an outlet for fines which are a problem for expanders, though so far the tonnage used has not been large.

The outlook for perlite is closely geared to construction activity, but there is a trend toward a percentage increase in the use of perlite in plaster and concrete.

PHOSPHATE ROCK

E. Robert Ruhlman, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Large deposits of phosphatic sand containing from 8 to 31 percent P_2O_5 in northeastern North Carolina were delineated by recent groundwater studies by the Federal Geological Survey in cooperation with the North Carolina Division of Mineral Resources. Exploration of these deposits by industry began in 1957 and mining and processing methods were being investigated. Technical and economic studies concerning the Baja California phosphate-bearing sands continued. The Bureau of Mines completed tests of a phosphate-rock planer in Montana deposits and planned to conduct further tests in the Idaho-Wyoming-Utah area.

The United States output of marketable phosphate rock in 1957, from Florida, Idaho, Tennessee, Montana, Utah, and Wyoming, was estimated at 14.3 million tons, a 9 percent drop from 1956.

French Morocco and Tunisia, major producers of phosphate rock, became independent countries during 1957 and may begin marketing their own output, thus abolishing the French phosphate-rock syndicate.

PLATINUM-GROUP METALS

J. P. Ryan, Commodity Specialist
Branch of Rare and Precious Metals

World production of platinum-group metals reached a new high in 1957 for the tenth successive year but domestic consumption was substantially below 1956. Reflecting the lower demand and increased world supply, platinum prices dropped from a high of \$103-\$107 a troy ounce to a low of \$77-\$80 an ounce in December. The price of palladium was lowered slightly from \$23-\$24 an ounce to \$21-\$22½; other platinum-group metal prices remained unchanged.

Domestic production comprising crude platinum from Alaska placers, byproduct platinum-group metals from copper and gold refining, and platinum-group metals from secondary sources, supplied about 15 percent of domestic requirements. The Union of South Africa and Canada continued to supply most of the United States requirements. Platinum of Soviet origin, reaching the market in substantial quantities during the year, contributed to the lowering of prices.

Net imports of platinum-group metals were estimated to have dropped about 34 percent to 658,000 ounces. Domestic consumption, as measured by sales to industry, was estimated at 720,000 ounces, 16 percent below 1956.

The petroleum-refining industry continued as the principal market for platinum in 1957; however, sales to this industry for catalytic use were estimated to be 23 percent below those of 1956. Sales of palladium used chiefly for contacts in the electrical industry declined about 11 percent during the year. Sales of platinum-group metals for use in jewelry and the decorative arts, and for dental and medical applications also were substantially lower in 1957.

World output of platinum-group metals rose about 13 percent in 1957 to an estimated 1.1 million ounces, distributed approximately as follows: Union of South Africa 540,000 ounces; Canada 400,000; Russia 125,000; Colombia 26,000; United States 21,000.

In view of the decline in business activity and lower inventory requirements for platinum as a catalyst in gasoline reforming operations, the short-term outlook for platinum-group metals is for continued oversupply. As new reforming plants under construction or planned in the United States and Europe come into production, demand for platinum as a catalyst will increase. Newly developed applications for platinum also may lead to increased consumption and alleviation of the oversupply situation. New applications include the use of platinum anodes in automatic electrical systems for protecting ships hulls and propellers against corrosion, platinum for reignitors in jet engines, and platinum alloys in permanent magnets.

The development of mine reserves of platinum-group metals and construction of production facilities in the Union of South Africa have provided productive capacity adequate to meet foreseeable future demand. Furthermore, the completion of new production facilities in Canada scheduled for 1960 also will contribute greatly to assuring an adequate long-term supply of platinum-group metals.

POTASH

E. Robert Ruhlman, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Development of Canadian potash deposits expanded considerably during 1957. Three shafts were being sunk and by the end of the year were 2,500, 1,200-plus, and 300 feet deep. A total of 18 companies, from the United States, Canada, and West Germany, were reported exploring or developing deposits. Initial production was scheduled for 1959.

Output of marketable potash in the United States in 1957 was estimated at 2.2 million short tons. New Mexico had six producing companies that supplied over 92 percent. The remainder came from California, Utah, Michigan, and Maryland.

Concern was expressed by industry officials regarding possible overproduction. The United States price was cut 2 cents a unit of K_2O. The long-range outlook was for continuing expansion.

RARE-EARTH METALS

Charles T. Baroch, Acting Chief
Branch of Rare and Precious Metals

Domestic production of rare-earth minerals in 1957 was from bastnasite in California and New Mexico, monazite in Florida, Idaho, and South Carolina, euxenite in Idaho, and the minor minerals, yttrofluorite, gadolinite, and samarskite, in Colorado. Total mine shipments of all types and grades of concentrates were estimated at 800 tons of rare-earth oxides. Monazite from the Union of South Africa continued as the chief source of the rare-earth metals. It was processed primarily for its thorium content to fill Government contracts and to supply increasing industrial nonenergy demands for thorium. This has resulted in continued greater supplies of byproduct rare-earth compounds. The Bureau of Mines estimates that 1957 industrial consumption of metals and compounds totaled about 2,600 tons of rare-earth oxides.

Research by industry and Government resulted in new scientific data and uses. New techniques were developed for flame-spraying rare-earth oxide coatings on metal surfaces to give components greater resistance to heat and corrosion. The yttrium subgroup of the rare-earth elements, sometimes called the heavy rare-earth metals, has been of particular interest. Of these, yttrium, gadolinium, and erbium are finding uses in artificially made garnets which have a high paramagnetism that makes them useful as ferrites in electronic devices.

A long-range research program to develop new uses for the rare-earth elements, sponsored by seven producers of rare-earth chemicals, was started by Battalle Memorial Institute.

SAND AND GRAVEL

W. W. Key, Commodity Specialist
Branch of Construction and Chemical Materials

Production of sand and gravel in 1957 apparently increased over record 1956 despite the lag in getting the construction phase of the Federal highway program under way in all areas, the cement strike,

and tight money in housing construction. The estimated 650 million tons of sand and gravel, produced at an average value of slightly less than a dollar a ton, made them the leading commodities in dollar value.

The tonnage outlook for the sand and gravel industry is better than at any time in history, but rigid specifications, keen competition, and depleting reserves are important factors in making any forecasts. The sand and gravel industry depends primarily upon construction and particularly upon highway paving for volume outlets. Fortunately, highway construction shows a sharp upward trend which is expected to continue many years under the present and anticipated development programs.

In 1957, the nation saw an increase in the use of portable plants capable of serving markets in immediate areas from local deposits. On the other hand, the number of plants producing over a million tons of sand and gravel a year has also increased.

SELENIUM

Frank L. Fisher, Commodity Specialist
Branch of Rare and Precious Metals

Domestic selenium production continued at a record pace in 1957 despite a severe drop in consumption. Producers' stocks increased sharply, imports declined, and the price decreased from the 1956 high. All the primary selenium produced in the United States and Canada during 1957 was a byproduct of the electrolytic refining of copper.

Selenium production totaled an estimated 1,050,000 pounds in 1957 compared with 1,117,000 pounds in 1956. Imports decreased nearly 39 percent to an estimated 12,000 tons a month for the year. Most imports came from Canada. Lesser quantities were received from Japan and West Germany. Selenium also was recovered from lead flue-dusts imported from Mexico.

Producers' stocks of selenium climbed from 191,000 pounds at the beginning of 1957 to a record 650,000 pounds at the end of the year. The increase was largely of the commercial-grade metal.

The price of selenium dropped from $15 a pound for commercial-grade at the beginning of 1957 to $7.50 a pound in December. The comparatively high 1956 price was largely responsible for sharp inroads by substitutes into selenium consumption. High-purity silicon and germanium were substituted for selenium in manufacturing some rectifiers, mercury dyes replaced selenium compounds to some extent in the pigment industry, and ferrotellurium was used in place of ferroselenium in manufacturing stainless steel.

SILVER

J. P. Ryan, Commodity Specialist
Branch of Rare and Precious Metals

Both domestic mine production of silver (38.9 million ounces) and consumption by the arts and industry (95 million ounces) declined moderately in 1957, reflecting curtailment of base-metal mining operations and the decline in business activity, respectively. Net inflow of silver rose sharply during the year to a postwar high of 198.4 million ounces due to the return of lend-lease silver which accounted for 138.3 million ounces. Of a total obligation of 410.8 million ounces, all but

27.7 million ounces owed by Saudi Arabia and Ethiopia was repaid by the end of the year.

The four leading silver-producing states—Idaho, Utah, Arizona, and Montana—again accounted for more than 80 percent of domestic production, nearly two-thirds of which was a byproduct of base-metal ores.

World output of silver in 1957 rose slightly to about 223 million ounces. Mexico continued as the leading silver-producing country, followed by the United States, Canada, and Peru. These four countries supplied nearly 59 percent of the world output. Free silver stocks in the Treasury increased to 127.4 million ounces and total Treasury stocks at the end of the year were 2,014.3 million ounces.

The price of silver on the New York market fluctuated in a narrow range during the year, between a high of 91⅜ cents and a low of 89⅜ cents an ounce; the average price was virtually the same as 1956. The Treasury purchase price for domestic production remained unchanged at 90½ cents an ounce.

Legislation to repeal the silver-purchase laws was again introduced in Congress and was referred to the Committee on Banking and Currency and Ways and Means, but no further action was taken.

New industrial applications of silver and silver alloys continued to be developed during the year. A new-type solid electrolyte battery, using silver bromide with a silver anode, was developed to meet requirements for high voltage-to-volume, long storage, and standby service. Silver-plated aluminum bus conductors for electrical installations became commercially available for the first time in 1957 and were expected to find widespread industrial use.

STEEL

James C. O. Harris, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

Steel experienced the third best year in its history in 1957 with the production of 112.7 million tons, compared with 115.2 million in 1956 and the all-time record of 117 million tons in 1955. In the second half of 1957, steel output dropped 10 percent below the record rate of the first half of the year.

Improved blast-furnace and operating techniques, along with high scrap prices, contributed to a new record in pig-iron production of 78.6 million short tons. Although scrap prices dropped sharply during the last half of 1957, blast-furnace output did not decline substantially until December. The ratio of scrap to pig iron consumed in September was 47-53 percent, compared with 50-50 during the first half of the year.

At the end of 1957, blast and steel furnace capacities reached new highs of 91.0 and 140.7 million tons, respectively. Steelmaking capacity increased 7.2 million tons, with the second highest annual gain, while capacity for blast furnaces increased 4.2 million—the highest gain on record. New steelmaking capacities by type of process and gain or loss during 1957, in millions of tons, were: Open hearth 122.3, plus 5.4; electric 13.3, plus 1.8; Bessemer 4, minus 0.5; and oxygen converter 1.1, plus 0.5.

The majority of the blast-furnace-capacity increase was accomplished through enlargement and modernization of existing furnaces; however, three new furnaces were blown in during the year—at Morris-

ville, Pennsylvania, Sparrows Point, Maryland, and Fontana, California. The 2-million-ton increase in steelmaking capacity at Bethlehem Steel's Sparrows Point plant makes this the world's largest steel works with a capacity of 8.2 million tons.

Shipments of steel in 1957, including exports, totaled 80 million tons, compared with 83.3 million tons in 1956 and 84.7 million in 1955. Receipts by the automotive industry, 14 million tons (19 percent of domestic shipments), were slightly higher than in 1956. Other major industries showing increases were construction (including maintenance), shipbuilding, oil and gas, and industrial equipment. Steel shipments to warehouses and distributors (2.2 million tons less than 1956), showed the greatest decrease. Consumption by the container, railroad, electrical equipment, and appliances industries also dropped. Steel exports in 1957 totaled 4.6 million tons, compared with 3.6 million in 1956.

Average weekly hours worked per employee in the steel industry during 1957 was 39.1 compared with 40.4 in 1956. The average number of employees for the year was 538,000 compared with 534,000 and the average hourly wage was $2.68 in 1957 compared with $2.52 for the previous year.

The average composite price of finished steel, as published by *Iron Age*, was 5.8 cents a pound compared with 5.358 in 1956.

During the year the American steel industry continued to improve iron- and steelmaking facilities, develop new direct iron-reduction processes, and expand vacuum melting facilities.

The use of oxygen and humidification of blast-furnace blast received further attention. In an experiment at National Steel's Weirton, West Virginia, plant, pig-iron output was increased 19 percent by using a blast enrichment of 4 percent oxygen. Direct iron processes widely discussed during the year included: The R-N process, the Dwight-Lloyd-McWane process, the Cyclosteel process, the H-iron process, the Madaras process, the Esso-Little process, the Diamond-Alkali process, and U. S. Steel's Nu-iron process. Nearly every major steel plant had a pilot plant in operation, and the Bureau estimates that between $10 and $12 million was being spent annually on research in this field. Vacuum-melting facilities continued to expand with the increased demand for superior steels and alloys. A survey showed that at the end of 1957 capacity of facilities totaled about 20 million pounds of induction vacuum melting and 50 million pounds of consumable-electrode, vacuum-arc melting.

In steelmaking the use of oxygen received further attention during the year. Jones & Laughlin Steel Corporation constructed the Nation's second oxygen steel-making plant at Aliquippa, Pennsylvania. Inland Steel used oxygen and made steel in an open-hearth furnace without fuel. In 1957, for every ingot ton of steel made, more than 200 cubic feet of oxygen were used. One oxygen steelmaking plant was under construction by Acme Steel. The technique to be employed by Acme is to use oxygen converters to make steel from molten iron from two hot blast cupolas. The combination of cupolas with converters is new in the United States.

STONE

W. W. Key, Commodity Specialist
Branch of Construction and Chemical Materials

Substantial progress was made in the Federal highway program in 1957, with emphasis on land acquisition. Although output of crushed stone did not expand as rapidly as anticipated, it apparently increased over record 1956, despite reversals in the construction field. The Bureau of Mines estimates that about 540 million tons of stone was used mainly for road construction and concrete aggregate. Large quantities also were used for many other purposes.

A matter of growing importance to the industry was the difficulty of operating quarries adjacent to metropolitan areas.

As in the case of sand and gravel, stone production is expected to continue at a high level, primarily because of the increased highway construction. Stone sand was used in areas where suitable natural sand was not available.

Some permanent plant operators used job-site portable plants to offset the tendency of contractors to produce their own aggregates where conditions are favorable.

Dimension stone had important markets in the building and monumental trade, but this tonnage represented only a small percentage of total production.

SULFUR

L. P. Larson, Commodity Specialist
Branch of Construction and Chemical Materials

Owing to growing competition from new production facilities being developed in Mexico, France, Canada, and other countries, the production of Frasch sulfur in the United States declined in 1957 from the all-time high established in 1956.

Recovery of brimstone in the purification of natural and refinery gases continued to increase as new installations became operative during the year. Sales of domestic Frasch sulfur declined as deliveries to domestic markets were reduced. American producers encountered serious competition in world and domestic markets as Mexican producers sought new markets for their expanded production. As a result American producers reduced prices by about $3 per long ton in an effort to maintain their positions in the market. The new schedules thus placed the United States producers' domestic prices at $23.50 and $22.50 per long ton f.o.b. mine, respectively, for bright and dark sulfur; export prices were reduced to $25 (bright) and $24 (dark) per ton f.o.b. port. In December the price spread between United States and Mexican producers was further reduced by an increase of $1 per ton in the price of Mexican sulfur.

Domestic output of Frasch sulfur in 1957 totaled 5,491,000 long tons, 15 percent below the record production of 1956. Sulfur recovered from gas increased, reaching a record of 519,000 tons. Shipments from mines declined from 5,676,000 in 1956 to 5,031,000 tons in 1957; stocks of Frasch sulfur increased from 3,935,000 tons in 1956 to 4,423,000.

TALC, SOAPSTONE, AND PYROPHYLLITE

Donald R. Irving, Assistant Chief
Branch of Ceramic and Fertilizer Materials

Combined mine production of talc, soapstone, and pyrophyllite in the United States decreased 4 percent to an estimated 707,000 tons in 1957 from the alltime high of 739,000 tons reported in 1956. However, it was the third successive year that production exceeded 700,000 tons, and was the third highest annual output ever recorded. A factor contributing to the decline was lower demand for ceramic floor and wall tile. Production continued to come from 14 states, with virtually all reporting decreases.

The outlook for 1958 is uncertain, although the long-term outlook is for further growth.

THORIUM

James Paone, Commodity Specialist
Branch of Rare and Precious Metals

Thorium consumption for nonenergy purposes increased about 70 percent in 1957 as a result of continued rising demand for thorium for magnesium-thorium alloys.

Domestic production of monazite, the source of thorium, came from South Carolina, Idaho, and Florida. The two principal manufacturers of refined thorium compounds in the United States were the Lindsay Chemical Company, West Chicago, Illinois, and Davison Chemical Company, Division of W. R. Grace & Company, Baltimore, Maryland.

About 12,000 to 14,000 tons of monazite containing 5 to 6 percent ThO_2 was produced by the Free World. Most of this came from the Union of South Africa and the remainder from the United States, Ceylon, Korea, and Australia. The Blind River area of Ontario, Canada, was the most promising potential source of thorium announced during the year. Potential thorium output might be 3 to 4 million pounds of thorium oxide a year.

The price of monazite concentrate from the Union of South Africa ranged from $250 to $285 a ton. Domestic prices were a matter of negotiation between buyer and seller and varied from about $25 to $40 a percent-ton of contained thorium oxide.

Davison Chemical Company, Curtis Bay, Maryland plant, intended for processing Government stockpile monazite, was shut down in 1957 because the process installed was not adequate to handle the wide variation in monazite quality encountered. Davison's Erwin, Tennessee plant, completed in 1957, is the first commercial solvent-extraction facility in the United States for the production of nuclear-grade thorium-oxide, as well as a plant for making thorium metal and thorium alloys.

Largest use for thorium was in magnesium-thorium alloys. The demand for magnesium-thorium alloys is expected to continue. Use of thorium in manufacturing incandescent gas mantles remained at the same level as in 1956. The nuclear use of thorium presents a large potential. Although several power reactors using thorium as fuel are being investigated and the AEC is allocating some $4 million on research on thorium, the future of thorium in atomic energy was not clear in 1957.

TIN

James W. Pennington, Assistant Chief
Branch of Base Metals

World mine production of tin in 1957 declined 3 percent below 1956 to an estimated 173,500 long tons. Output of tin at world smelters also dropped and totaled about 170,000 tons, or 6 percent less than 1956. The United States failed to account for any mine production and contributed only 1,600 tons to smelter production; on January 31, 1957, operations were suspended at the Longhorn smelter in Texas, and on February 15 the Government sold the plant to the Wah Chang Corporation.

The decrease in industrial activity in the latter part of 1957 lowered world consumption of primary tin 3 percent to an estimated 156,000 tons. Of this, the United States accounted for 56,000 tons, compared with 60,500 tons in 1956. Imports of metallic tin to the United States in 1957 were down about 5 percent from the 62,000 tons of 1956. The New York price of tin averaged 96.17 cents a pound in 1957, a drop of 5 cents from 1956.

TITANIUM

F. J. Cservenyak, Chief
Branch of Light Metals

United States production of ilmenite in 1957 increased about 4 percent over 1956, while output of titanium pigments, which use most of the ilmenite, decreased 6 percent. Domestic rutile production was slightly lower, but rutile imports set a new record. Despite a record in sponge output, most producers were operating at less than half capacity by the end of the year because of cutbacks in defense requirements.

Domestic ilmenite output reached a new high of 710,000 short tons.

Rutile production was slightly below the peak established in 1956, and totaled approximately 11,800 short tons. On November 20 Metal and Thermit Corporation opened a rutile and ilmenite processing plant at Beaver Dam, Virginia. The plant has a planned capacity of 5,000 short tons of rutile a year and represents an investment of $1,250,000.

E. I. du Pont de Nemours & Co., Inc., announced it would take over its Lawtey and Starke, Florida, plants in February 1958. Humphreys Gold Corporation had been operating the plants for du Pont under a 10-year lease. In December du Pont disclosed that mining at Lawtey and Starke would be curtailed due to lower demands for titanium ore and zircon.

Union Carbide Corporation in April revealed plans to mine a titanium deposit on Amelia Island, off northeast Florida. The company owns about 3,000 acres on the island and will mine the deposit by bucket dredge capable of handling about 500 tons of sand an hour from which about 15 tons of heavy minerals will be recovered.

The Quebec Iron and Titanium Corporation, Sorel, Quebec, Canada, the only North American commercial producer of titanium slag, announced in February that it would increase titanium-dioxide-slag production 60 percent by adding three ilmenite smelting furnaces to its plant. Work will cost about $16 million and is planned for completion by early 1959.

Imports of ilmenite concentrate in 1957, primarily from India and Canada, increased about 30 percent over 1956. Imports of rutile concentrate, practically all from Australia, increased about 75 percent.

Ilmenite prices remained constant during the year, but quoted prices for rutile followed a steady downward trend from $190 to $230 a short ton (94 percent TiO_2 f.o.b. Atlantic seaboard) at the start of 1957 to $120 to $125 at the end of the year.

The titanium sponge metal industry operated at a record high level during the first quarter of 1957, but cutbacks in military requirements caused declines in production and consumption for the remainder of the year. The military cutback was reportedly due to a reduction in the number of certain aircraft to be acquired and a stretch-out of deliveries. Despite the cutback, production of 17,250 tons for the year exceeded 1956 by about 20 percent. Sponge consumption was about 20 percent below the previous year. Much of the excess sponge metal was delivered to General Services Administration under Defense Production Act contracts.

Allied-Kennecott Titanium Corporation selected Wilmington, North Carolina, as a site for its titanium metal plant. Facilities will be integrated from the production of titanium tetrachloride to titanium mill products, such as forgings and billets.

Another industry development was the formation of the Mallory-Sharon Metals Corporation by Mallory-Sharon Titanium Corporation and National Distillers will be owned one-third each by P. R. Mallory Company, Sharon Steel Company, and National Distillers Chemical Corporation.

For the first time since 1952, production and shipments of titanium pigments declined. Production of pigments, as measured by the titanium dioxide content, decreased about 6 percent, and shipments went down 7 percent from 1956. However, both were second only to 1956.

The only titanium-pigment expansion announced during the year was by E. I. du Pont de Nemours & Co., Inc. Du Pont will build a 125-ton-per-day titanium-dioxide pigment plant on a 1,500-acre site near New Johnsonville, Tennessee. Pigments will be produced by the conversion of titanium tetrachloride to titanium dioxide rather than by the conversion of the sulfate as practiced by the other domestic producers. The plant is expected to be in operation by early 1959. On September 11 Canada's first titanium-pigment plant was opened at Varennes, Quebec, by Canadian Titanium Pigments, Ltd., a subsidiary of the National Lead Company. The plant will use titanium slag produced 40 miles away by the Quebec Iron and Titanium Corporation, Sorel, Quebec.

TUNGSTEN

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Domestic production of tungsten concentrate in 1957 declined approximately 50 percent compared with 1956. Peak output of the year was in January and thereafter output diminished as suspension of Government purchase continued. By December, only 4 operators were in production: Tungsten Mining Corporation in North Carolina; Union

Carbide Nuclear Company, in California; Climax Molybdenum Company, in Colorado; and Nevada-Massachusetts Company, in Nevada.

Stocks of concentrate held by domestic producers exceeded 4 million pounds, contained tungsten, compared with 1,477,000 pounds in December of 1956 and 523,000 pounds in December 1955.

Prices declined steadily during the year from $27.25 to $27.75 on January 3 to $11.50 to $13.25 on December 3, per short ton unit of tungsten trioxide c.i.f. U. S. ports, duty extra.

Consumption of concentrate in 1957 exceeded 8 million pounds, contained tungsten. Somewhat more than half of this was supplied by domestic producers, according to a comparison of mined production, mine shipments, and accumulation of stocks.

Consumption of tungsten products, including metal powder, scheelite, ferrotungsten, chemicals and scrap was in tool steel and other alloys (about 41 percent), carbides (about 40 percent), tungsten wire, rod, and sheet (about 13 percent) and miscellaneous uses (about 6 percent).

Imports of concentrate in 1957 were approximately 13.8 million pounds, contained tungsten, a decrease of nearly 34 percent from 1956. Bolivia, Brazil, Argentina, Australia, Canada, Korea, and Peru were the leading producers, in that order. Each supplied more than 1 million pounds and together they supplied nearly 90 percent of the total imports.

Because of the tungsten surplus in recent years and the urgent need for better high-temperature materials in jet aircraft, missiles, and numerous more commonplace uses, tungsten research in 1956 and 1957 has placed increased emphasis on uses.

URANIUM

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Uranium production increased in 1957, but greater expansion was predicted in 1958. Domestic uranium concentrate purchases by the Atomic Energy Commission totaled about $171 million in 1957, over 25 percent more than in 1956; purchases in 1958 may exceed the 1957 figure by 45 percent.

Uranium-ore production from over 1,200 properties totaled 3.6 million tons, representing a 20-percent increase over 1956. About 8,600 tons of mill concentrates was produced during the year, an increase of more than 40 percent over 1956. Four mills started during the year, bringing the total operating mills to 16.

The domestic ore reserve was estimated at 75 million tons, with an average grade of 0.27 percent U_3O_8. Over half of the reserve is in New Mexico, and the remainder in Utah, Wyoming, Colorado, Arizona, Washington, Oregon, Nevada, North Dakota, South Dakota, Texas, California, Montana, and Idaho.

Uranium was used in producing atomic weapons and developing atomic power. Since atomic power is of prime importance to the uranium industry, investigation of power reactors continued with the result that 14 high-temperature power-producing reactors, 7 of which became operational in 1957, were functioning in the United States by the end of the year. During 1957, 24 research and test reactors began operating; 3 atomic-powered submarines were in commission, and 16

were under construction or on order, and two uranium-fueled surface vessels were being built.

Imports of uranium concentrates exceeeded 11,800 tons of U_3O_8. Foreign production continued in Belgian Congo, Canada, Union of South Africa, France, Portugal, Australia, and Sweden.

Some limitation on expansion of uranium production was advocated by the Atomic Energy Commission in an attempt to maintain a strong, continuing domestic uranium industry. The long-term outlook for uranium is for expanding production to fulfill the needs for atomic power. Continued exploration will be necessary to provide ore reserves for this growth. On the basis of the projected rate of extraction in 1959 the discovery and development of 7 million tons of ore annually are needed merely to maintain the domestic reserve position.

VANADIUM

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Vanadium production as a byproduct of carnotite ores of Colorado Plateau continued to exceed demand.

Output of vanadium pentoxide (V_2O_5) in 1957 was about 12.6 million pounds—about 10 percent below 1956. Domestic consumption of vanadium was about 4.1 million pounds (vanadium content) in 1957—a 7 percent decrease from 1956. There were no imports of vanadium ore and concentrate in 1957, but 20,406 pounds (gross weight) of vanadic acid, anhydride, salts and compounds, and mixtures of vanadium, 7 pounds (gross weight) of vanadium carbide, and 400 pounds (gross weight) of chromium nickel and chromium vanadium were imported through November 1957. Exports of vanadium in various forms were approximately 1.2 million pounds (vanadium content)—about 39 percent less than in 1956.

Substantial research and development by industry and Government continued on methods for producing high-purity, ductile vanadium, on vanadium alloys, and on determining the effect of vanadium in special steels.

Supplies of vanadium for domestic consumption and for export appear to be adequate for several years. The depletion of commercial grades of vanadium-bearing carnotite ores may necessitate the development of other sources.

ZINC

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World overproduction of zinc continued throughout 1957. That excess, in conjunction with cutbacks in consumption and stockpiling by the United States, led to increased stocks of metal in the hands of domestic producers and a drastic decline in zinc prices with consequent mine closings.

Domestic mine production declined from a rate of 590,000 tons a year in the first quarter of 1957 to a rate of 435,000 tons in the fourth quarter and totaled 520,000 tons in 1957, compared with 542,000 tons in 1956. Domestic mine production of 520,000 tons of recoverable zinc was augmented by imports of 785,000 tons of primary zinc as metal

and concentrate so that new primary supply totaled about 1.3 million tons in 1957.

Domestic consumption totaled 840,000 tons of primary slab zinc, 71,000 tons of redistilled slab, and 104,000 tons of zinc in ore consumed directly to make zinc oxide and other zinc products. Thus, total primary consumption of 945,000 tons was about 300,000 tons less than primary supply.

On May 6 the price of zinc, Prime Western grade, East St. Louis, declined 1½ cents to 12 cents a pound and by July 2 had fallen to 10 cents where it stayed throughout the remainder of the year.

Thereafter many zinc and zinc-lead mines either closed or curtailed output. Major mines which closed included the Sterling mine in New Jersey, Vinegar Hill group in Wisconsin, Eagle-Picher mines in Kansas and Oklahoma, Van Stone mine in Washington, the Kearney and Groundhog mines in New Mexico, Combined Metals Reduction Company mines in Nevada, Keystone and Rico Argentine in Colorado, Darwin mine in California and the San Xavier, Athletic, Johnson Camp, and Trench group in Arizona. The Anaconda Company curtailed output at its Butte, Montana mines, and most of the mines in the Coeur d'Alene region cut back from a 6- to a 5-day work week.

ZIRCONIUM AND HAFNIUM

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In 1957 production of zirconium metal expanded rapidly to about 800 tons. Most metal was used in construction of nuclear reactors, particularly those for naval vessels.

Four companies, operating six plants, were active in the field. Various modifications of the digestion, purification, and reduction steps of the Kroll process were installed or under test. A fifth company studied zirconium preparation by fused-salt electrolysis.

Processing and fabrication capacity has kept pace with expanded sponge production; four large operations and several smaller ones produced ingot, shapes, and cladding.

Open market prices of zirconium were $7 to $14 a pound for reactor-grade metal, and $5 to $10 for the commercial grade. Atomic Energy Commission contract prices ranged from $4.50 to $12.

Hafnium production grew in proportion to production of reactor-grade zirconium. Little was offered on the market, and prices between $20 to $40 a pound were quoted.

Domestic output of zircon concentrate was about 54,000 tons. Australian production was between 90,000 and 100,000 tons, of which about 45,000 tons was shipped to the United States. Brazilian zircon disappeared from the domestic market, and imports from other countries were negligible. The price of imported zircon started the year at $64 to $68 a long ton, c.i.f. Atlantic coast ports, but a gradual decline brought the price to $50-$51 at year's end. Domestic prices held constant at $50 (Jacksonville) and $55 (Starke) a short ton, f.o.b. mines.

Mentioned as the major cause of the price decline was the reduced consumption of zircon for facings by brass foundries, partly because of less business activity.

The outlook for zirconium metals calls for gradually increasing consumption as more naval and merchant vessels are equipped with atomic power, and as additional civilian installations are made, based on zirconium's low nuclear cross-section, comparatively low specific gravity, and good corrosion resistance.

Use of zircon for metal production should require a slowly increasing portion of the annual supply. The long-term outlook for zircon for foundry, refractory, ceramic, and chemical uses is for gradual increases.

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